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SYSTEM OF OBSTETRICS.

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CONTENTS OF VOLUME II.

PAGE

DISEASES AND ACCIDENTS OF LABOR. By THEOPHILUS PARVIN, M. D., LL.D. 17

THE FORCEPS.—EMBRYOTOMY. By EDWARD P. DAVIS, A. M., M. D. 121

THE PREMATURE INDUCTION OF LABOR. By JAMES C. CAMERON, M. D. 194

VERSION. By JAMES C. CAMERON, M. D. 209

THE CÆSAREAN OPERATION, SYMPHYSIOTOMY, LAPARO-ELYTROTOMY, AND LAPARO-CYSTECTOMY. By ROBERT P. HARRIS, A. M., M. D. 247

PUERPERAL INFECTION. By HENRY J. GARRIGUES, A. M., M. D. . . . 290

INFLAMMATION OF THE BREAST AND ALLIED DISEASES CONNECTED WITH CHILDBIRTH. By HENRY J. GARRIGUES, A. M., M. D. 379

THE ETIOLOGY OF PUERPERAL FEVER. By HAROLD C. ERNST, M. D. 401

SOME COMPLICATIONS OF THE PUERPERAL STATE INDEPENDENT OF SEPTIC INFECTION. By BARTON COOKE HIRST, M. D. . 461

INSANITY AND DISEASES OF THE NERVOUS SYSTEM IN THE CHILDBEARING WOMAN. By JAMES HENDRIE LLOYD, A. M., M. D. 545

THE MANAGEMENT AND THE DISEASES OF THE NEWBORN INFANT. By J. LEWIS SMITH, M. D. 633

THE SURGICAL DISEASES OF INFANCY AND EARLY CHILDHOOD. By STEPHEN SMITH, A. M., M. D. 763

CONGENITAL ANOMALIES OF THE EYE. By G. E. DE SCHWEINITZ, M. D. 821

LIST OF WOOD ENGRAVINGS.

FIG. PAGE
1. Annular Laceration of the Cervix 18
2. Transverse or Semicircular Grinding Through of the Uterus 19
3. Three Degrees of Inversion of the Uterus 41
4. Inversion of Uterus, from specimen in Musée Dupuytren 42
5. Vaginal Tampon in Placenta Prævia 60
6. Arresting Hemorrhage by Compression of Uterus 68
7. Rueff's Forceps 122
8. Palfyn's Forceps, joined by Heister 123
9. Rathlaw's Forceps 124
10. Chamberlen's Forceps 125
11. Levret's Forceps 126
12. Smellie's Forceps 126
13. Hubert's Axis-traction Forceps 127
14. Tarnier's Forceps, first model 127
15. Tarnier's Forceps, modified 128
16. Simpson's Forceps 129
17. Simpson's Axis-traction Forceps 129
18. Naegele's Forceps 130
19. Breus' Axis-traction Forceps 130
20. Lusk's Tarnier Forceps 131
21. Hodge's Forceps 131
22. Wallace's Forceps 131
23. Elliott's Forceps 132
24. Smith's Forceps 132
25. Sawyer's Forceps 133
26. Poullet's Axis-traction Forceps 134
27. Stevenson's Device for Axis Traction 134
28. Forceps at Inferior Strait 138
29. Protecting Perineum in Forceps Delivery 139
30. Forceps in Defective Occipital Rotation 140
31. Forceps in Face Presentation 142
32. Tarnier's Forceps applied to Breech 143
33. Forceps at Superior Strait 145
34. Birth-canal at End of Stage of Dilatation 147
35. Smith's Axis-traction by Leverage 148
36. Traction with Tarnier's Forceps 149
37. Delivery by Tarnier's Forceps at Perineum 149
38. The Vectis 162
39. Hodge's Craniotomy Scissors 165
40. Smellie's Scissors 165
41. Naegele's Perforator 165
42. Blot's Perforator 165
43. Martin's Trephine, parts together 166
44. Martin's Trephine, parts asunder 166

FIG. PAGE
45. Braun's Curved Trephine 166
46. Simpson's Cranioclast 167
47. Braun's Cranioclast 167
48. Hicks' Cephalotribe 168
49. Blot's Cephalotribe 168
50. Breisky's Cephalotribe 169
51. Lusk's Cephalotribe 169
52. Simpson's Basilyst 170
53. Tarnier's Basiotribe 171
54. Application of Tarnier's Basiotribe 172
55. Basiotripsy Accomplished 172
56. Crotchets 172
57. Craniotomy Forceps 173
58. Braun's Hard-rubber Tube 173
59. Hard-rubber Syringe 173
60. Use of Simple Perforator 174
61. Craniotmy with Martin's Trephine 175
62. Head after Delivery by Cranioclast 176
63. Braun's Decapitation Hook 179
64. Decapitation by Hook 179
65. Tarnier's Apparatus for Feeding Premature Infants 201
66. Braun's Colpeurynter, dilated 205
67. Barnes' Fiddle-shaped Hydrostatic Bag 205
68. McLean's Modification of Barnes' Hydrostatic Bags 206
69. McLean's Bags, dilated 206
70. Tarnier's Cervical Dilator, unexpanded 207
71. Tarnier's Cervical Dilator, expanded 207
72. Tarnier's Cervical Dilator, *in situ* 207
73. Pinard's Abdominal Supporter, side view 213
74. Pinard's Abdominal Supporter, front view 213
75. Version in Transverse Presentation 215
76. Version in Breech Presentations 216
77. Internal Podalic Version, French method 220
78. Internal Podalic Version, German method 221
79. Braxton Hicks' Method of Combined Podalic Version 222
80. Braxton Hicks' Method, second stage 223
81. Braxton Hicks' Method, third stage 224
82. Braxton Hicks' Method, final stage 224
83. Podalic Version in Head Presentation 225
84. Braun's Repositor, arranged as Noose-carrier 227
85. Male Gum-elastic Catheter, used as Braun's Repositor 227
86. Male Gum-elastic Catheter, as Noose-carrier 227
87. Male Gum-elastic Catheter, as Noose-carrier, German method 228
88. The Stilette 228
89. Podalic Version when Arm is Prolapsed 230
90. Method of Lifting Impacted Shoulder from Brim 231
91. Method of Liberating Posterior Arm 234
92. Method of Liberating Anterior Arm 235
93. Manual Extraction of After-coming Head—Smellie 237
94. Manual Extraction of After-coming Head—Veit 238
95. Manual Extraction of After-coming Head—Prague method 239
96. Extraction when Chin is Arrested at Symphysis 239
97. Wiegand-Martin Method of Extraction 240
98. Forceps Delivery of After-coming Head, Dorso-anterior Position 242
99. Forceps Delivery of After-coming Head, Dorso-posterior Position 242

FIG. PAGE
100. Various Forms of Bandages 334
101. Puerperal Mastitis forming Abscess 387
102. Puerperal Mastitis, Glandular Variety 389
103. Lobules of Mammary Gland of Puerpera 390
104. Lower Half of Breast during Lactation 391
105. Miss Murphy's Breast-binder 393
106. Pigment of Areola following Incisions 396
107. Cultures of the Streptococcus erysipelatis, Staphylococcus pyogenes aureus, and Streptococcus pyogenes 453
108. Muscular Tissue of Pregnant and Puerperal Uterus 463
109. Uterine Muscle-fibres Nine Days Post-partum 463
110. Diagrammatic Representation of Decidua 466
111. Lochia on Seventh Day 466
112. Lochia on Second Day 466
113. Lochia on Fourth Day 466
114. Frozen Section of Puerperal Uterus 467
115. Chart showing Fever in Bilateral Laceration of Cervix 474
116. Chart showing Fever in Deep Laceration of Vaginal Wall 474
117. Fibrinous Polyp 478
118. Frozen Section of Puerperal Uterus in Anteflexion 480
119. Retroflexion of Puerperal Uterus 480
120. Chart of Emotional Fever from Dread of Operation 493
121. Chart of Fever Case from Exposure to Cold 494
122. Chart showing Fever from Constipation in Puerperal State 495
123. Chart showing Reflex Fever from Mammary Congestion 496
124. Chart showing Fever followed by Expulsion of Tape-worm 497
125. Chart showing Fever following Perforation of Uterus 497
126. Chart showing Temperature in Eclampsia 498
127. Chart showing Temperature in Syphilitic Fever 500
128. Chart showing Influence of Labor on Temperature of Phthisis . . . 501
129. Chart showing Fever in Muscular Rheumatism during Pregnancy 521
130. Mammary Gland of a Nullipara (Silesia) 536
131. Mammary Gland of a Nullipara (Silesia) 536
132. Mammary Gland of a Nullipara (Bavaria) 536
133. Mammary Gland of a Nullipara (Bavaria) 536
134. Acrania 653
135. Hydrencephalocele 656
136. Spina Bifida 658
137. Pavement Epithelium covered by Spores of *Oïdium Albicans* 744
138. Spores and Branches of *Oïdium Albicans* 745
139. Vertical Section through Umbilicus and Linea Alba 766
140. Supernumerary Little Finger 767
141. Supernumerary Thumb 767
142. Seton Inserted in Webbed Fingers 769
143. Diagram of Flaps in Operation for Webbed Fingers 769
144. Webbed Finger with Thick Septum 769
145. Operation for Webbed Fingers 770
146. Pulsating Vascular Tumor of Orbit 770
147. Cicatricial Contraction of Mouth 771
148. Large Mouth, Pendulous Growth near Ear 771
149. Showing Development of Intermaxillary Bone 772
150. Hare-lip, Congenital Cicatrix 772
151. Hare-lip as Slight Notch 772
152. Hare-lip as Deep Fissure of Right Side 772
153. Uncomplicated Double Hare-lip 772

FIG. PAGE
154. Fissure of Hard and Soft Palate 772
155. Hare-lip complicated with Fissure of Alveolus 772
156. Operation for Hare-lip, Position for Infant 774
157. Elastic Compressor applied over Coronary Artery 774
158. Application of Twisted Suture 775
159. Twisted Suture 775
160. Hainsby's Truss 775
161. 162. Operation for Partial Hare-lip (Nélaton) 776
163. Operation for Double Hare-lip 777
164. Malgaigne's Operation for Hare-lip 777
165. Operation for Single Hare-lip 777
166. 167. Collis' Operation for Hare-lip 777
168. 169. Hare-lip, Giraldès' Method 778
170. 171. Double Hare-lip 778
172. Complicated Hare-lip, before Operation 779
173. Complicated Hare-lip, Front View 779
174. Complicated Hare-lip, Side View after Operation 779
175. Slight Fissure of Palate 780
176. Large Fissure of Palate 780
177. Hypertrophy of Tongue 783
178. Strangulation of the Bowel 785
179. Intussusception 785
180. Intussusception of Cæcum 789
181. Vaginal Fistula 793
182. Imperforate Anus 797
183. Incision for Imperforate Anus 798
184. Band attached to External Wound in Operation for Imperforate Anus . . 799
185. Meningocele 801
186. Meningocele at Root of Nose 801
187. Large Spina Bifida 804
188. Congenital Coccygeal Tumor 805
189. Wood's Operation for Extroverted Bladder 807
190. Wood's Operation for Extroverted Bladder, flaps applied 807
191. 192. Bigelow's Operation for Extroverted Bladder 807
193. Irritated Congenital Phimosis 808
194. Circumcision 808
195. 196. Circumcision, Preparation of Flaps 809
197. Congenital Inguinal Hernia 810
198. Infantile Hernia 810
199. Encysted Form of Infantile Hernia 810
200. Common Scrotal Hernia 810
201. Cysts of the Cord: Encysted Hydrocele 811
202. Hernia of Funicular Process 811
203. Fascia at Umbilicus 812
204. Congenital Umbilical Hernia 813
205. Umbilical Truss 813
206. "Greenstick" Fracture of Clavicle 815
207. Club-foot, Talipes Equinus 816
208. Club-foot, Talipes Calcaneus 817

FIG. PAGE
209. Club-foot, Congenital Varus 818
210. Stretching Foot in Talipes Varus 818
211. Varus Treated by Bandage 818
212. Operation for Club-foot, before Operation 819
213. Operation for Club-foot, Bones Removed 819
214. Operation for Club-foot, after Operation 819
215. Club-foot, Valgus 819
216. Coloboma of Eyelids 822
217. Cryptophthalmos 825
218. Epicanthus 827
219. Dermoid Tumor of Corneo-scleral Border 832
220. Incomplete Coloboma of Iris 835
221. Anophthalmos 838

DISEASES AND ACCIDENTS OF LABOR.

By THEOPHILUS PARVIN, M. D., LL.D.,

PHILADELPHIA.

LACERATIONS OF THE UTERUS.

TEARS of the uterus occurring in labor may be divided into those of the neck, of the body, and those of both neck and body.

Tears of the Neck of the Uterus.—It almost invariably happens in a primipara that there is a transverse laceration of the vaginal portion in labor: this tear is generally deeper upon the left than upon the right side, but as a rule does not even in the former extend as far as the vaginal vault. So, too, some tearing of the os in labor usually occurs in multiparæ. But these are physiological tears, and only exceptionally demand the attention of the obstetrician. If, however, a tear of the cervix, whether of the vaginal portion alone or extending above it, is followed by hemorrhage, the recognition of the accident and immediate treatment may be required. Such injury is liable to occur if forceps be applied and extraction made before the os is sufficiently dilated; and so, too, podalic version and extraction under a similar condition may cause it. Remy[1] has reported a case of grave hemorrhage from a tear of the neck of the uterus; extraction of the presenting head was made by the forceps when the os was incompletely dilated, and the left side of the cervix was thereby torn. The hemorrhage was so serious that compression of the aorta was employed, and then a tampon was introduced and allowed to remain twenty hours; recovery.

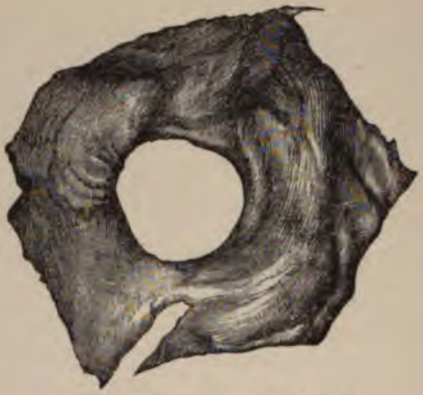
The hemorrhage is the dominant immediate symptom, though the liability to septic infection created by such a tear ought also to be considered. Possibly hot-water injections or the introduction of a tampon of styptic cotton pressing directly upon the bleeding part may arrest the flow. But in case neither is used, or if both have been tried unsuccessfully, the suture furnishes a sure reliance. In its application we should, as advised by Schroeder, draw the uterus down with Museux's forceps or with a strong tenaculum until the injured part is exposed at the vulvar orifice; then the introduction of sutures will be comparatively easy: these sutures may be of silver wire or of silkworm gut.

---

[1] *Archives de Tocologie*, Oct., 1887.

During the operation the patient lies upon her back, the lower limbs well flexed upon the abdomen; of course antiseptics are carefully employed. Very serious injury has been done to the cervix in instrumental labor by one blade of the cephalotribe or of the forceps being applied external to the os, and thus a part of the neck is seriously bruised or even actually torn away. To state that such accidents have occurred ought to be sufficient warning against the carelessness and ignorance that would render their repetition possible.

FIG. 1.



Annular Laceration of the Cervix.

A few cases of what has been termed annular separation of the cervix have been recorded. This accident results from an unyielding cervix and strong uterine contractions. Barnes[1] refers to a case reported by Gervis in which ringform detachment was not complete. It was replaced without sutures, as the patient was very prostrate. She recovered, and the ring reunited. Duparcque[2] mentions meeting with a case in which the entire anterior lip was detached, so that at first it seemed as if there were a double os uteri.

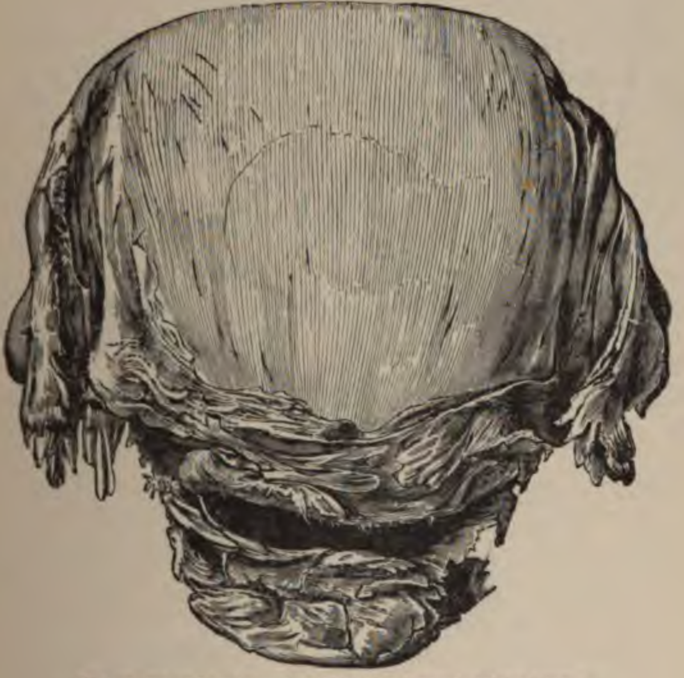
Rupture may be consequent upon attrition, the uterine tissue, usually cervical, being forced against abnormal bony projections from some portion of the pelvic inlet, exostoses of pelvic bones; and thus *usur*, a wearing away of those tissues, results. Naegele states that Kilian has drawn especial attention to a deformity of the ilio-pectineal eminence in which this, instead of presenting its normal oval shape, has a spine-like process; similar sharp projections may occupy other parts of the pelvis; to the basin thus deformed the name of *Stachelbecken*, pelvis spinosa, was given; and Kilian showed the injurious effect in labor resulting from this cause. Depaul has stated that four out of twenty-four deformed pelves in his collection show exaggerated developments of particular parts, forming knife-like projections; according to his observation, this deformity was most frequent at the pubic crest. The following remarkable case is quoted by Duparcque:[1] A woman had been in labor twelve hours, the presentation being pelvic. The os uteri was not yet completely dilated when all the anterior part of the neck, from one side to the other, separated. Immediately the fœtus passed into the abdominal cavity, and it was extracted with great difficulty in less than two hours; it was dead. The mother died five hours after being delivered. The basin was found a little narrow; the point of the sacrum had passed through the posterior part of the uterus (was this the sacro-vertebral angle?); the internal and salient border of the pubis and of the iliac bones resembled somewhat the edge of a paper-cutter, and had cut all the thickness of the uterus as if it had been divided by a ligature. Breus[2] has published a case of injury done to the uterus by its tissues being worn through in consequence of

---

[1] *Obstetric Medicine and Surgery.* A similar case will be found in the *Transactions of the Philadelphia Pathological Society*, vol. i., reported by Dr. Keller.

[2] *Histoire complète des Ruptures et des Déchirures de l'Utérus, etc.*

FIG. 2.



Transverse or Semi-circular Grinding-through of the Uterus.

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[1] *Op. cit.*

[2] "Ueber perforirende Usur des Uterus," *Wien. med. Blatter.*

the pressure of the head of the child, forcing these tissues against the sharp promontory of a rachitic pelvis.

Rupture of the Body of the Uterus.—Ruptures limited to the body of the uterus have resulted from the giving way of cicatrices consequent upon a rupture in a previous labor or of a Cæsarean section. Barnes admits that in some cases of this accident excessive fatty degeneration of the muscular tissue of the organ was present. He adds, however, that to prove that a particular cause existed in a limited number of cases is very different from establishing it as a general or universal law; and there is abundant evidence to prove that in a considerable number of cases no such excess did exist. But of course cases belonging to these categories are very few, and we may assume, with Zweifel, that in some instances spontaneous rupture of the uterus results from a change, a displacement of the individual muscle-layers of the uterus.

Rupture of the Neck and of the Body of the Uterus.—By far the great majority of grave ruptures of the uterus involve the neck and the body, and the explanation of their occurrence given by Bandl is generally accepted. In normal labor the first stage is regarded as ending when the os uteri is so dilated that it offers no resistance to the presenting part, and this, therefore, under the influence of uterine contractions, descends and is expelled from the uterus, but with descent of the head, for example, ascent of the os uteri occurs. The activity of the uterus is exerted during that stage in a retraction of the os, drawing it upward over the presenting part. But if there be a marked disproportion between the presenting part and the canal it must pass through—as, for example, that caused by a shoulder presentation or a hydrocephalic head or by a narrow pelvis—advance is impossible; meantime, the uterine force struggling against an invincible obstacle, the effort at retraction of the cervix still continues, and the tissues of the cervix and of the lower portion of the body of the uterus are greatly stretched and attenuated. In consequence of the right obliquity of the uterus—this being the fact in the great majority of cases—the retraction as a rule is greater upon the left side than upon the right. "This explanation makes clear the reason for these ruptures always involving the cervical portion, and thence extending upward to the contraction-ring and downward into the cul-de-sac, and why they are in only rare instances directly longitudinal, but have an oblique or transverse course; their greater frequency upon the left side is not to be attributed to the greater frequency of the pressure of the head upon that side, but to the usually occurring right obliquity of the uterus and to the greater retraction of the left uterine wall."[1] To the question as to why the vagina is not made tense, drawn up by this retraction of the cervix, the answer is that the uterine ligaments antagonize the retraction of the cervix, and they become very tense, especially the round ligaments.

---

[1] Zweifel.

It is fortunate that the most frequent of uterine ruptures does not come without warning: there are almost always clear indications of the advent of the accident, so that the obstetrician may, in most instances, avert it. The premonitory symptoms are the tense condition of the round ligaments, the great thinning of the lower uterine segment, the ascension of Schroeder's contraction-ring (see Fig. 289, Vol. I.), so that from its normal position near the pelvic inlet it may now be only the breadth of two or three fingers below the umbilicus; this ring can be recognized by palpation, and during a uterine contraction can be seen making a somewhat obliquely-lying furrow across the abdomen, while at the same time that portion of the uterus below this furrow "is prominent as if it were a distended bladder;" but the use of the catheter will prevent, in a case of doubt, such mistake.

The finger in the vagina passes readily between the presenting part and the cervical wall, which is everywhere found extremely thin. The general condition of the patient also foretells the accident. She is restless, and suffers not only during uterine contractions, but also in the intervals; the abdomen is tender;[1] the suffering and the anxiety cause an excited and frequent pulse, and there is some elevation of temperature; her countenance expresses anxiety. Instances of this variety of rupture that do not present premonitory symptoms are quite exceptional.

Spontaneous and Traumatic Ruptures.—A rupture of the uterus is spontaneous when it occurs independently of obstetric intervention, whether this be manual or instrumental. On the other hand, the uterus may be torn by the introduction of the forceps blades through an undilated os, by slipping of the blades after their intra-uterine application, or by violently dragging the head through an undilated os; the application of the cephalotribe may be followed by the same result. So, too, it is probable that the accident frequently occurs from podalic version, either attempted or accomplished, when the symptoms of threatened rupture are present: even though the operator may in a given case accomplish this version with ease, as the last straw breaks the camel's back, so the slightest additional strain given by fingers or hand may determine tearing of the greatly-stretched lower uterine segment.

Frequency of the Accident.—Collins gives the proportion of cases of rupture of the uterus as 1 in 482 labors; McClintock, 1 in 737; Ramsbotham, 1 in 4429; Jolly, 1 in 3403; Bandl, 1 in 1200; Galabin, 1 in 3371. But all these statistics have possibly two sources of error. Fatal cases, though known by the obstetrician in attendance, do not always find their way into medical journals or even into mortality statistics. Still others are not known even to the medical attendant at the time of the accident or during the subsequent illness; the patient dies of septicæmia or she may perish immediately of hemorrhage, and only the post-mortem reveals the cause of the infection in the one case or of the mortal bleeding in the other. Evidently, if an autopsy had not been made such cases would not have been known, and as comparatively few autopsies are made outside of hospitals, it is quite probable —nay, certain—that some cases of uterine rupture are unknown. Hervieux[1] narrates a case from the practice of Dubois in which he performed podalic version on account of narrowed inlet; the woman died the next day, no symptom of uterine rupture having been manifested, yet there was found at the post-mortem an irregular rent involving a part of the anterior wall of the vagina, the entire length of the neck in front, and a portion of the left side of the uterus. He also refers to a case occurring in the Maternité in his service in which Tarnier by external means changed a pelvic into a vertex presentation; the woman was delivered on the 9th and died on the 11th of November, and at the autopsy there was found a rent in the side of the neck a little more than two inches long, extending from the internal os to the union between the neck and the vagina. In a paper presented four years ago to the Philadelphia County Medical Society, I narrated a case of uterine tear which was not suspected during life, but, the woman dying of septicæmia, a post-mortem showed that there was a complete rent involving the left side of the cervix and the lower third of the body of the uterus. Since that time a medical gentleman of this city brought me the uterus of a woman who died in labor from hemorrhage, so reported too in the certificate to the Board of Health, and examination showed that the cause of the hemorrhage was a tear extending from the external os nearly as high as the contraction-ring. Hervieux remarks that in some cases the uterine tear is made silently —neither pain nor complaint nor crisis, and if the patient dies, as is usually the case, one is astonished to find at the autopsy a rupture which had not been even suspected.

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[1] Spiegelberg.

If we add to these silent tears, many of which remain unknown because autopsies in private practice are not frequent, and a few in which death does not follow the accident, those cases which, though recognized by the practitioner, are not made known, it is probable that the accident, though by no means frequent, is less rare than published statistics indicate.

Causes of Uterine Rupture.—Duparcque in his well-known work stated as the first of his conclusions that ruptures of the uterus were caused by contractions of the organ. This view is also sustained by

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[1] *Traité clinique et pratique des Maladies puerpérales.*

Tyler Smith, Trask, Jolly, and others—indeed, meets with general acceptance. Laying aside those comparatively rare instances in which the uterus is torn by obstetric intervention, whether manual or instrumental, and those instances of injury, also rare, in which change in the tissues at a particular part of the organ, whether from previous traumatism or from degeneration[1] has occurred, and therefore the weakened part yields even in normal labor, the greater number of cases of this injury result from undue resistance to the force of uterine contractions. The normal effect of that force is the expulsion of the child. But if some invincible obstacle is present preventing that expulsion, uterine contractions, strong and continued, end in uterine rupture. Such obstacle may be presented by pathological conditions of the utero-vagino-vulvar canal, by contracted pelvis, by a malpresentation, or by the abnormal size of the child, this increase being usually from a pathological condition, as hydrocephalus. In addition, rupture may occur without any of the conditions just mentioned, solely from the improper administration of ergot. A midwife, anxious to hurry the labor of a primipara, gives large doses of ergot in the first stage of labor, and the vigorous contractions of body and fundus striving against the normal resistance of an only partially dilated os, the organ is torn: I have met with an instance of this kind, and very many have been recorded by others.

That resistance of the os uteri from pathological changes, and that narrowing of the vulvo-vaginal canal, as from cicatrices, may lead to rupture of the uterus, have been proved by several cases of this accident which have been reported. Pelvic contraction is an important cause. Thus Trask[2] found in 417 cases "at least 74" of contracted pelvis.

The influence of the increased size of the fœtus in causing rupture of the uterus is shown by the fact that the accident is much more frequent in male than in female births: in 34 cases of Collins, 23 were males; in 20 of McKeever, 15; in 13 of Bandl, 10; and thus in 67 cases of uterine rupture the sex of the children was in 48 male.[3] A partial increase in the volume of the fœtus has been observed in several cases of rupture of the uterus, as from ascites, abdominal tumors, and hydrocephalus. Keith[4] found 16 cases of uterine rupture in 67 instances in which the fœtus was hydrocephalic; in the statistics of

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[1] Kormann (*Lehrbuch der Geburtshülfe*) refers to Windelschmidt's report of rupture of the uterus from changes in the structure of the muscular walls consequent upon placental endometritis of syphilitic origin. He also mentions the case of Saexinger, in which an abscess in the uterine wall led to the accident.

[2] *Am. Journ. Med. Sci.*, July, 1856. Trask's statement is thus given incorrectly by Charpentier (*Traité pratique d'Accouchement*): "Trask in 300 cases has noted in 74 per cent. of these cases pelvic contraction."

[3] Spiegelberg: *op. cit*

[4] Simpson's *Obstetric Works.*

Schuchard[1] there are 13 cases of this accident in 73 cases of hydrocephalus.

The accident has occurred much more frequently in multiparæ than in primiparæ, only 12 per cent., according to Bandl, of the latter being found among the entire number. That primiparity protects against, and multiparity predisposes to, uterine rupture has received different explanations. The one most generally accepted is that repeated pregnancies lead to thinning or weakening of the walls of the uterus. But, according to Spiegelberg, the cervix furnishes greater resistance in the primiparæ, also the os internum is not so quickly drawn above the child, while the connections of the uterus with the pelvis are stronger; the greater force of abdominal pressure pushes the uterus against the latter. In multiparæ, lateral, and especially anterior, deviation of the uterus is frequent, and hence excessive stretching of the neck on one side is frequent. Zweifel states that the lessened elasticity and contractility of the uterus is the chief cause of the greater liability in old primiparæ to rupture, but that it is probable lessened abdominal pressure is also a cause. Nevertheless, it seems to me that two of the most important causes have been omitted. One of these is the much greater frequency of a shoulder presentation in multiparæ than in primiparæ, such malpresentation occurring in only 12 per cent. of the latter, according to the statistics of the Berlin clinic, and in only 6 per cent., according to those of Spiegelberg's clinic. The other is the progressive increase in the size of the children in successive pregnancies. It is possible that hydrocephalus is much more frequent toward the close of the childbearing period: statistics are wanting to prove this point, but should it be established there would be an additional reason for the greater frequency of the accident in multiparæ than in primiparæ.

Degree, Direction, and Complications of Uterine Ruptures.—The tear may be complete or incomplete; the latter involves only the muscular wall, the peritoneal coat remaining entire, but underneath this covering there is usually extravasated blood; so too, especially if there be entrance of air into the uterine cavity, by the introduction of the hand, as for turning or for the application of the forceps, subperitoneal emphysema may occur. If the peritoneum is not torn, there is no hemorrhage into the abdominal cavity, but there may be grave hemorrhage external to it. Goodfellow[2] has reported an instance of rupture of the uterus, the woman dying on the third day, and the autopsy showed a transverse rupture of the cervical portion of the uterus on the right side above the utero-vaginal junction, and a considerable hemorrhage in the connective tissue of that side extending into the iliac region beneath the peritoneum: "there was no blood in the abdominal cavity, and the peritoneum was not torn." The woman was at the beginning of the eighth month of pregnancy when taken in labor; she died after three days, and at the autopsy there was found a rent in the fundus of the uterus through which the ovum had entered the abdominal cavity.

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[1] "Ueber die Schwierigheit der Diagnose und die Haufigheit der Uterusruptur bei fötaler Hydrocephalie," *University of Berlin Thesis*, 1884.

[2] *Am. Journ. of Obstet.*, 1884.

It is stated that in some very rare cases the peritoneum alone is torn, but such an accident cannot by any means approach the gravity of what is generally known as rupture of the uterus.

Uterine ruptures are generally quite extensive, often permitting the escape of the entire fœtus or a part of it into the abdominal cavity. The rent in at least one instance was so large that the entire ovum entered the abdominal cavity. This case was reported by Salin[1] of Stockholm. Uterine ruptures may be complicated by tears of the vagina, even of the rectum or of the bladder, and by the prolapse of intestines through the rent.

SYMPTOMS AND FATALITY.—In many cases during a pain of unusual severity or an obstetric manipulation, as the introduction of a blade of forceps or of the hand for performing version, suffering of unusual severity is felt by the patient. She may be, as Trask has stated, conscious of something having given way in her; "she feels a tearing or rending sensation." That there is caused by the tearing a noise heard by those present, although this has been reported in some instances, seems extremely doubtful. The woman's face is pale and covered with a cold sweat; there are nausea and vomiting, and the pulse is irregular, rapid, and thread-like; the respiration is hurried, difficult, and sighing; the vision becomes imperfect, and there is ringing in the ears. In most instances the uterine contractions cease, and upon vaginal examination the presenting part has receded. There is severe pain in the abdomen, and the latter presents a notable change in form if the fœtus has in whole or in part entered its cavity or if there has been great hemorrhage into it. Jolly[2] in the 580 cases which he has collected found the following symptoms:

Abrupt cessation of contractions was observed in	218 cases.
Gradual " " " " "	38 "
Change in the pulse " " "	179 "
Prostration " " "	151 "
External hemorhage, slight in 33, " " "	148 "
Retrocession of the presenting part was " "	146 "
Abdominal pain " " "	115 "
Alteration of countenance " " "	115 "
Fœtal parts felt immediately under abdominal wall in	77 "
Acute pain at the moment of rupture in	62 "

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[1] *Centralb. für Gyn.*, 1882.

[2] *Paris Thesis*, 1870.

Hemorrhage may be internal or external, or both varieties may occur. In some instances abrupt cessation of the fœtal movements, hitherto quite active, has been observed, and there is arrest of the sounds of the fœtal heart. Kiwisch, McClintock, Montgomery, Paully, Ross, Creighton, and Schatz have pointed out as a pathognomonic phenomenon the occurrence of emphysema at the level of the hypogastric region. Trask regarded the diagnostic marks as two—the recession of the presenting part, and the power to distinguish the limbs of the fœtus directly beneath the abdominal wall. Jolly found in thirty-seven cases that the uterine contractions did not cease, or only temporarily, and that in some they retained their normal force.

A vaginal examination may not only make known the recession of the presenting part—such recession, however, does not occur if that part has become wedged in the pelvis—and hemorrhage, but also by it the rent may be felt, and possibly through it prolapsed intestine.

Rupture of the uterus is one of the gravest accidents in labor. The child almost inevitably perishes at once, while the mother is in immediate danger from shock and hemorrhage, and in proximate from septic infection. Death may at once follow the accident. Thus, Dr. Churchill[1] states that in a case under his care the woman died in five minutes after the rupture. While Jolly gave the percentage of recoveries as 17, Spiegelberg regarded this as much too high, and considered 5 per cent., the result established by Hugenberger, as being near the truth. So, too, Zweifel after quoting Trask as deriving from his statistics that the mortality of expectant treatment was 78 per cent., after delivery by the vagina 68 per cent., and after laparotomy 24 per cent., says these statistics cannot be correct. The surprisingly small mortality when laparotomy was done is to be explained by the fact that cases operated upon which recovered are reported, while the others are passed over, and the relative smallness of the figures.

TREATMENT.—This comprises that which is required in threatened rupture and that required after the accident has occurred. In the former immediate delivery is demanded, and this must be effected without additional stretching of the cervix. Hence, embryotomy is preferable to version, for, as observed by Zweifel, the introduction of the hand for the accomplishment of the latter is no less dangerous than turning the child in the uterus closely enclosing it. If the child occupies a transverse position, embryotomy; if the head presents in a contracted pelvis, craniotomy; or if there be hydrocephalus, perforation,—constitute the treatment as briefly advised by Zweifel; and he adds that transverse position, narrow pelvis, and hydrocephalus are almost the sole complications of labor, bringing the imminent danger of rupture of the uterus.

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[1] *Theory and Practice of Midwifery*, 6th ed.

After rupture of the uterus, too, delivery must be made as soon as possible. If the woman is greatly prostrated, stimulants—especially a hypodermic of sulphuric ether—are indicated, and other suitable means employed to bring about reaction. The modes by which delivery is to be effected will depend upon the position of the child, the presentation, and the special obstacle to labor which has been the chief cause of the injury. The child is either in the uterus or in the abdominal cavity, or partly in each. In the first case, supposing the head to present, the forceps or the cephalotribe is indicated: of course the head is first opened if the latter instrument is employed. If the head be not accessible, delivery by podalic version is indicated. In the third case, still, delivery through the natural passage is the rule if the part of the fœtus that has entered the abdomen can be easily brought into the uterine cavity and without increasing the rent. But if such restoration is impossible without this additional injury to the uterus, and in the second condition that has been stated, abdominal section is required. After delivery through the natural passage, a 2 per cent. solution of carbolic acid is used to thoroughly wash out the cavity, and a drainage-tube introduced. Frommel,[1] pursuing this method, had in 1880 three successful cases, and the next year Hecker[2] reported a success obtained in like manner. Schlemer[3] in 1882 reported a case of rupture in which a portion of intestine prolapsed through the rent, the fact of the rent and of the prolapse being ascertained after delivery with the forceps; the bowel was restored, a drainage-tube introduced, an injection of carbolized water employed; the injection was repeated daily, and the woman recovered.

Associated with drainage a compressive abdominal bandage is employed. The drainage-tube is of glass, and is T-shaped; injections are, as a rule, not made through it into the abdominal cavity, but the nozzle of a syringe may from time to time be introduced into the tube, and fluid drawn out: the tube is removed in about a week. Zweifel, after stating that Schroeder, Frommel, Gräfe, Hecker, and Morsbach have had excellent results from this treatment, adds that he has also had in his clinic a case that was successful by means of peritoneal drainage.

In a case of rupture[4] reported by Rhinestädter the peritoneal cavity was washed out through the drainage-tube with a 1 per cent. carbolic-acid solution, an antiseptic vaginal tampon introduced, and an ice-bladder applied to the abdomen over the rupture. The vaginal dressing was renewed the next day, the drainage-tube was removed four weeks after the delivery; the woman recovered.

Zweifel[5] rests the decision as to extirpating the uterus after abdominal section upon its contracting well or failing to contract, for in the latter case the consequent danger of hemorrhage into the abdominal cavity is so great that the removal of the organ is advisable.

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[1] "Zur Therapie der Uterusruptur," *Centralblatt für Gynäkol.*, 1880.

[2] *Ibid.*, 1881. [3] *Ibid.*, 1882. [4] *Op. cit.* [5] See Kormann: *op. cit.*

INJURIES OF THE VAGINA.

It is proposed under this head to consider not only lacerations, but also contused and perforating wounds of the vagina received in labor.

It is convenient, as Spiegelberg[1] has done, to divide tears and other injuries of the vagina into those of the upper, of the middle, and of the lower part of the vagina. Vaginal tears are frequently associated with corresponding injuries of the uterus. Nevertheless, McClintock,[2] from the statistics of the Rotunda Lying-in Hospital, found 35 of 108 which involved the vagina only, or merely the os uteri with it; it is thus seen that the cases of vaginal injury are a little more than one-third of the entire number. Spontaneous tears of the vaginal vault are more frequently transverse than longitudinal, while those in the middle portion of the vagina are generally longitudinal. In some instances the vagina has been by a circular rent partially, or even completely, separated from the uterus. Johnson and Sinclair[3] give the case of a patient in whom a fatal injury of this kind occurred: the woman was a multipara, but delivery being impossible because of cicatrices in the lower part of the vagina even after division of the cicatricial tissue was made with a bistoury, craniotomy was performed: death occurred the next day. An instance of perforation of the posterior cul-de-sac by a vaginal douche, used to induce labor at the eighth month of pregnancy because of pelvic deformity, is given by Budin.[4] So, too, the vaginal vault has been torn by the badly-directed blade of forceps or cephalotribe. Both spontaneous and artificial rents of the upper posterior portion of the vagina are especially liable to occur in case there be a pendulous abdomen permitting anterior displacement of the uterus, for by this displacement the tissues are stretched and thinned. Hart[5] has shown that the posterior vaginal wall is structurally weak at its upper half inch, while it is more elongated than the anterior wall in labor. Rupture is most common where the posterior vaginal wall is covered by peritoneum, and when it occurs is a tension tear like cervical rupture. Instances of injury to the vagina anteriorly and posteriorly have occurred from the use of the perforator: in one case[6] the practitioner, wishing to open the child's head, made a rent in the bladder, permitting the introduction of three fingers, and in another case,[7] the obstetrician, attempting the same operation, thrust his instrument through the tissues, and applied it to the sacral promontory, mistaking it for the fœtal head. Rupture of the vaginal vault has been caused by forcible introduction of the hand into the uterus for the purpose of performing version.[1]

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[1] *Op. cit.* [2] *Dublin Journal of Medical Science*, May, 1866. [3] *Midwifery.*

[4] *Des Lesions traumatiques chez la Femme dans les Accouchements artificiels*, par Pierre Budin, Paris, 1878.

[5] *Trans. Edinb. Obstet. Soc.*, vol. viii. [6] *Provincial Medical Journal*, 1843.

[7] Budin: *op. cit.*

Prolapse of the intestine through the rent has been observed in several cases. Danyau[2] in 1850 collected 17 cases of rupture of the vagina in which the fœtus passed into the abdominal cavity: 4 of these patients recovered. Others too have recovered, though the injury permitted prolapse of the intestine. Moysant has reported a case in which a woman being in labor the forceps was vainly applied, and then delivery by podalic version tried; the trunk was extracted, but the head left behind; the woman died in a few hours, and at the post-mortem the fœtal head was found in the left side of the abdominal cavity, having entered through a rent which extended from the uterine junction to the vulva.

McClintock[3] gives as the cause of spontaneous rupture of the vagina in the cases which he collected—1, diseases of the vagina; 2, disproportion between the size of the fœtal head and the maternal pelvis; and 3, osseous irregularity upon the inner surface of the pelvis. While, according to the same authority, the recoveries after uterine rupture are only 4½ per cent., they are after similar injury to the vagina 12 per cent.

The SYMPTOMS that have been most frequently observed in ruptures of the vagina are cessation of labor-pains, hemorrhage, recession of the presenting part, which, however, is slight unless the fœtus enters the abdominal cavity: prolapse of intestine or of omentum is a not infrequent complication. Shock too has been observed in many cases.

TREATMENT.—The treatment is very similar to that required in similar injury to the uterus. Prompt delivery is indicated, and usually this will be made through the vagina; arrest of bleeding will be accomplished by hot-water injections, by sutures, and in only exceptional cases will a styptic tampon be employed; a lateral rent or one involving the peritoneum will usually require a drainage-tube: of course antiseptics will be used in the immediate and in the subsequent treatment.

Rents of the Middle Portion of the Vagina.—These are usually superficial: they may be caused by careless use of the perforator or of the crotchet, or the vagina may be torn by sharp fragments of bones of the fœtal head in extraction after craniotomy. Injury may be done in the introduction of the blade of the forceps, this being forced instead of caused gently "to feel" its way to the desired point; so too injury may be done in the extraction, especially in case the blades are not accurately applied to the sides of the child's head and kept in such close relation, for the fœtal head ought to be a protection to the vagina from injury by the borders or by the ends of the forceps blades. Deep tears of the middle portion of the vagina may occur if there be structural change in its tissues, whether from malignant disease or from cicatricial contraction. Contused wounds of the vagina most frequently result from prolonged impaction of the head in the pelvic cavity—and as a consequence subsequent sloughing occurs—which if they involve the anterior wall of the vagina result in a vesico-vaginal fistula, or if the posterior a recto-vaginal fistula.

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[1] Spiegelberg: *op. cit.*, *Bulletins de la Société anatomique*, 1857.

[2] *Arch. méd.*

[3] *Op. cit.*

TREATMENT.—It rarely happens that bleeding from wounds of the middle portion of the vagina is considerable, and its treatment does not differ from that required in similar injury of the upper portion. The most important part of the treatment of the colpitis resulting from the injury will be the use of warm antiseptic injections—1 part of corrosive sublimate to 4000 of water, for example—and following the injection by introducing an iodoform suppository: if a contused wound involving the anterior wall be present, great care must be taken to prevent distension of the bladder; after sloughing of any part of the vaginal walls means must be used during the healing to prevent contractions, metal, glass, or hard-rubber dilators being introduced from time to time.

As showing the greater liability to injuries to the vagina in birth in case the child be male, the fact stated by Spiegelberg is significant: thus in 12 cases of vesico-vaginal fistula at his clinic and polyclinic, all the children were boys.

Tears of the Lower Portion of the Vagina.—Though these are in most cases associated with corresponding injuries to the perineum or vulva, yet some are not, and therefore should be considered separately. So far as spontaneous injuries of this class are concerned, their most frequent cause is excessive stretching of the vagina; they are usually superficial and situated at or near the median line; in some cases, however, they may have a diagonal course, or two diagonal tears may be united with a median tear having approximately the form of a Y. Contused wounds resulting from prolonged pressure by the presenting part are also found here, and they may be followed by sloughing, which may end in rectal or in perineal perforation. Improper use of the forceps is to be credited with many injuries to the lower part of the vagina: these injuries may result from too rapid extraction, but probably their most frequent cause is turning the handles of the forceps too soon toward the abdomen of the mother, and thus the points of the blades are withdrawn from the child's head and brought directly against the posterior wall of the vagina, making more or less deep furrows in its tissues: a similar accident has occurred from the attempt to withdraw the blades just before the expulsion of the head, a violent pain suddenly expelling the head, while the obstetrician, busy with the manœuvre mentioned, was powerless to prevent the rapid delivery. Dupuy[1] mentions a case in which, the feet presenting, one of these escaped by the vulvar opening, while the other, pressing strongly upon the vagina posteriorly, was forced through the perineum. I have seen a somewhat similar case, only the foot inflicting the injury made a rent at the lower portion of the recto-vaginal wall and protruded through the anus, there being also a slight tear in the posterior perineum. Dr. Barker[2] has published a case to which he was called where he found the perineum "enormously distended by the pressure of the head, and the left hand and forearm projecting through the anus." He did not attempt to restore the member, but delivered with the forceps. The patient's bowels were kept confined by opium for ten days, and complete cicatrization followed.

TREATMENT.—Bleeding from uncomplicated lacerations of the lower part of the vagina is usually only slight, and therefore can only exceptionally require means for its arrest. While, too, in most cases these tears are only superficial, and therefore require no treatment other than cleanliness and the use of antiseptic applications, in others their extent is such that not only to protect from septic infection and to secure their rapid healing, but also to guard against possibly permanent injury to the pelvic floor, sutures are plainly indicated. Properly prepared catgut is the best material for stitching the surfaces together, and the continuous suture may then be employed.

INJURIES OF THE VULVA AND OF THE PERINEUM.

The vaginal canal does not open immediately externally, but through the canal of the vulva, and during the expulsion of the fœtal head the latter becomes greatly increased, partly at the expense of the labia and adjacent external tissues, and partly by the stretched anterior portion of the perineum: the resisting vulvar ring has the fourchette posteriorly, the nymphæ and the greater lips at the sides, and the inferior margin of the vestibule above or anteriorly. Any part of this ring may be torn, and some part of it, generally the fourchette, is torn in the primipara; it is not uncommon for the rent to begin in the lower portion of the vagina—that is, at the true vaginal orifice—and thence extend to the vulva. Budin[3] from his own observations was led to remark: "Thus, then, it is the resistance of the vaginal orifice, hymeneal orifice, which in primiparæ renders the period of expulsion so long: it may be said that in them the fœtal head must successively escape three orifices—viz. the uterine, the vaginal, and the vulvar—and the resistance offered by the vaginal orifice is not the least." J. Matthews Duncan[1] refers to laceration of the vaginal orifice as frequently the first step to laceration of the fourchette or of the perineum more extensively, and regards this posterior laceration as inevitable.

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[1] *Considérations relatives aux Dechirures du Vagin à la Suite de l'Accouchement*, Paris, 1822.

[2] *The Puerperal Diseases*, p. 42.

[3] *Obstétrique et Gynécologie.*

Lateral tears involving one or the other nympha may occur: in some instances one of these may be divided in the median line, while in others there is partial separation of the base; or the tear may extend from the inferior margin of the vestibule backward by the side of the urethra or upward through the tissue of the vestibule to the clitoris, and if the laceration is deep the corpus cavernosum of this organ upon one side may be torn: in case of a deep tear, very considerable hemorrhage generally follows. Young[2] has narrated two cases of hemorrhage caused by a wound of the vestibule in labor, one of which was fatal, seen by him. In the patient that died he found a distinct tear five-eighths of an inch long extending from the left side of the urethra upward to the left of the clitoris. The bottom of the wound, which was about seven-eighths of an inch deep, presented a spongy appearance, the spaces of which communicated freely with each other and the underlying veins. In the second patient the hemorrhage was so great as to cause faintness: Young found that the flow was from a tear about one and a half inches long, running from the neighborhood of the clitoris, on the left side, downward toward the urethra. Pressure with the finger for five minutes stopped the hemorrhage, and to prevent its recurrence the wound was closed with two metallic sutures.

In regard to tearing of one of the nymphæ, Duncan describes it as beginning in the vaginal orifice, and at its side anteriorly, where the parietal protuberance has pressed, and states that this tear may bleed freely: the left side is more frequently the seat of tearing than the right.

Budin,[3] in a note upon a sign permitting the recognition of a hemorrhage from the walls of the vulva or of the vagina after delivery, remarks: "If the blood comes from the clitoris, it flows immediately externally as soon as the head has escaped, even before the expulsion of the trunk. If, on the contrary, it comes from rupture of the neck of the womb, it is doubtless effaced by the friction of the body of the fœtus against the greatly-distended vaginal walls. We ask, then, If it would not be more rational to conclude from the presence of a large stain of blood extending over the shoulder and the trunk that there was rupture of a vessel occupying the anterior part of the vagina?"

TREATMENT OF TEARS OF THE VULVA.—Tears of the fourchette, unless extending into the perineum, do not require special attention. In lateral tears we lessen the liability to septic infection and arrest hemorrhage by sutures, the material being preferably catgut. If a tear in the vestibule bleeds much, the hemorrhage can generally be stopped by compression, but, as a rule, one or two deep stitches are to be preferred.

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[1] "Papers on the Female Perineum."

[2] *Transactions of the Edinburgh Obstetrical Society*, vol. viii.

[3] *Op. cit.*

INJURIES OF THE PERINEUM.

These may be divided into contusions, perforations, and tears. Violent or prolonged pressure of the child's head upon the perineum may produce more or less bruising of the tissues, and from such contusion sloughing occur, so that a perineum which was entire when labor ended may some days afterward appear as if a tear had occurred during labor. Dewees[1] has narrated a case in his practice of a primipara in whom the head remained pressing upon the perineum for four hours because of her unwillingness to have forceps used; she then consented, and was delivered in fifteen minutes of a living child. "About the eighth day sloughing of the perineum commenced, and proceeded down to the sphincter ani and some distance up the vagina. The parts have healed, however, more fortunately than could at first have been expected, the perineum almost alone having suffered, leaving the rectum safe and the vagina without serious injury: the case now resembles a lacerated perineum." Cases of similar injury have been reported by Duncan[2] and by Hibberd.[3] Unjust reproach may be cast upon the obstetrician in whose practice such an accident follows labor, for a perineum the integrity of which seems complete immediately after delivery may several days or weeks later present the characteristics of more or less extensive laceration: the woman, being informed of the present condition by another practitioner, is very apt to blame her former attendant, even though the present one is wise and honest enough to refrain this suggestion.

There are no special directions as to the treatment of these lesions; their prevention will be chiefly accomplished by artificial delivery made before such injurious distension or prolonged pressure occurs.

Perforation or central rupture of the perineum, permitting the escape of the fœtus through this artificial opening, the anal and the vulvar ring remaining complete, has been observed in rare instances. Among the first cases reported were one by Nédey, 1778; Coutouly, 1788; Meckel, 1811; John Douglas of Dublin, 1822; and Merriman, 1826 It was the subject of a clinical lecture by Dupuytren;[4] and in that lecture there are given the following causes of the accident: The orifice of the vulva being placed high up toward the pubes, while the perineum presents from before backward a great extent, or, if the woman is lying horizontally, a considerable height. The vulvar orifice is in such a subject much lessened, this diminution being consequent upon a sort of prolongation of the perineum which occludes inferiorly a fourth, a third, or even half, of the opening. This vice of conformation may be congenital or accidental—in the latter case from reunion of the soft parts following a burn, for example. Another cause is the sitting position during labor: he states that this was the fact in Nédey's case, and that his own patient was so propped up by pillows as to be almost sitting. The importance of these two causes, thus presented by one of the greatest of French surgeons, is obvious. Remembering that in labor the presenting part first descends to the pelvic floor in very nearly a straight line, and then, in completing the passage through the birth-canal, turns in a direction almost at a right angle to that line which it has hitherto pursued, it can be readily seen that by the prolongation of the perineum toward the pubis and the lessened vulvar orifice, the second line, or axis of the canal, makes a more or less acute angle with the first. The presenting part—the head, for example—is placed at the bottom of a purse. The driving force of uterine and abdominal contractions does not meet with sufficient resistance from the perineum to develop a resultant force able to lift the head up from this depth. The difficulty must obviously be increased if the woman occupies a sitting position.

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[1] *System of Midwifery*, 8th ed., p. 287, 1837.

[2] "Papers on the Female Perineum."

[3] *American Practitioner*, 1881.

[4] *Leçons orales de Clinique chirurgicale*, tome troisième, Paris, 1833, p. 168.

Now, while in the majority of cases the penetration of the perineum at its thinnest part is followed by a tear extending anteriorly through the vulvar ring or posteriorly through the anal, in rare instances these rings remain entire and the fœtus is transmitted through the artificial ring. In order to understand the possibility of such transmission we must remember not only that the perineum is greatly elongated in labor, so that from measuring only a little more than an inch it may be four or five inches, or even more, but also that the rent is not longitudinal, but, as Dupuytren stated, it may be Y-shaped or it may be stellate, and that the tissues surrounding it are very easily stretched.

A third cause of the accident, stated by Moreau and accepted by Dupuytren, is too great curvature posteriorly of the inferior extremity of the sacrum and of the coccyx, or, which is the same thing, too great prominence of the sacro-vertebral angle.

Charpentier[1] has collected 48 cases of central rupture of the perineum, and in discussing the causes of this accident regarded the following three points as important: 1. The exaggerated height of the pubic symphysis, and the more or less faulty direction of the vulva resulting therefrom; 2, the particular state of the perineum—form, constitution, and extensibility; 3, the excessive intensity and irregularity of the uterine contractions.

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[1] *Archives de Tocologie,* 1885.

The prevention of this accident is to be sought by having the woman lie upon the side, and by directing the head of the fœtus forward to the vulvar ring; further, if that ring, whether from congenital formation or as a consequence of cicatricial contraction, be too small and too undilatable to permit the passage of the fœtal head, episiotomy is clearly indicated. Again, if a central tear in the perineum has begun, the obstetrician, bearing in mind the possibility of its extending backward, that more or less damage will be done the anus and rectum should the head pass through the rent, is justifiable in dividing the vulvar ring rather than risk the accident just mentioned, for an anterior opening is preferable to a posterior one. If the labor is over, the child having passed through the artificial opening, closure of that opening by sutures is indicated. Sir James Y. Simpson[1] has reported a case of perineal fistula left by the transit of the infant through the perineum, and has adduced two similar cases previously reported. At the conclusion of his paper he remarks: "To the preceding remarks let me merely add that, as a means of preventing central perineal laceration, and the chance, consequently, of perineal fistula as a result, we have to trust to—1st, the common methodic manual support of the perineum, so as to save excess of pressure upon it, while at the same time we push the head forward to the vaginal opening—a means which, in the practice of Denman and Lachapelle, succeeded in preventing the head from passing through the perineum after its central structures were split and burst; 2d, delivery of the head and its proper guidance through the vulva by the forceps, as has been effected by D'Outrepont, Hüter, and Braun in cases in which this accident was impending; and, 3d, lateral incisions, if absolutely necessary, of the anterior edge of the perineum, for in this, as in the more common longitudinal forms of ruptured perineum, it is, I believe, better practice to make one or two slight cuts on either side of the fourchette, so as to regulate the site and the direction of the lacerations that must occur, rather than leave their form and character to mere chance alone. It is always an infinitely more important matter to save the sphincter of the anus than the sphincter of the vagina."

Charpentier[2] has collected several cases in which the arm, descending by the side of the head, has perforated the perineum; also one case in which the lesion was caused by the elbow.

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[1] *Obstetric Memoirs and Contributions*, edited by Drs. Priestley and Storer, Philadelphia, 1856.

[2] *Op. cit.*

TEARS OF THE PERINEUM.—These are incomplete or complete. There are two varieties of the former: in the first of these the tear or fissure is of the mucous or of the cutaneous surface, while in the second both surfaces and the intervening tissues are involved. Further, perineal lacerations may be complicated with corresponding injuries of adjacent parts.

Tears of the perineum are not uncommon; indeed, they are frequent in primiparæ, and even multiparæ by no means always escape. In regard to the percentage of women who suffer from these injuries in childbirth, statistics of different observers so greatly vary[1] that it is unnecessary to quote them as conclusive, because such discrepancies can only be reconciled by supposing that there have been different methods of observation and different criteria of a perineal rent. There is one point, however, upon which statistics agree, and that is that these injuries are much more frequent in cases of delivery with the forceps. Nevertheless, let not the conclusion from this fact be that the instrument itself, by increase of the head circumference, causes the accident. The tear may come from the careless or hurried extraction, or from the resistance of a rigid perineum or of the vaginal or vulvar opening—a resistance which Nature's forces were unable to overcome. If a skilful hand holds the forceps, and tissues and time permit delay until sufficient dilatation or dilatability is secured, no perineum would suffer injury from the forceps which would not have occurred had the delivery been spontaneous; nay, more, the forceps properly used would preserve many a perineum from rupture.

Abnormal position of the vulvar orifice predisposes to perineal tears; so too if this orifice is undilatable or unusually small such accident is inevitable unless means of prevention are used. As Pajot has said, some perineums are destined to tear, and this depends upon the nature and quality of the tissue.[2] Whenever the labor occurs so rapidly that time is not given for the physiological softening and stretching of the tissues which furnish the final barrier to the escape of the fœtus, the integrity of the perineum is imperilled. "In those cases where the infant advances with extreme rapidity from the superior strait to the vulva, in accouchements made precipitate by excessive activity of the uterus, in labors ended by operative intervention, the perineal floor, insufficiently prepared, not having acquired its complete extensibility, runs the risk of being ruptured."[1]

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[1] The following passage is taken from Marduel, vol. xxvi., *Nouveau Dictionnaire de Médecine et de Chirurgie pratiques:* "Without referring to tears of the fourchette, which are almost the rule in primiparæ, and which Schroeder has found in his *accouchées* in the proportion of 61 per 100, we find the basis of the frequency of true tears of the perineum in German and English authors. Thus, Schroeder found these rents in 34½ per cent. of primiparæ, in 9 per cent. of multiparæ; Winckel saw 115 ruptures of the perineum in 1011 deliveries; Olshausen found 21 per cent. in primiparæ, 4.7 per cent. in multiparæ; Hildebrandt gives 7½ per cent.; Hecker, 3.66 per cent. for the Munich clinic." The author states that in more than 300 deliveries in the Lyons clinic he has not seen a single rupture of the perineum. Spiegelberg (*op. cit.*) has stated that of 3000 deliveries in his clinic, there were 102 cases, or 3.5 per cent., in which there was a tear from the fourchette more than 2.5 centimeters long.

[2] Hecker, who gave the general proportion of women who suffered from perineal tears as 3.66 per cent., found that in primiparæ from thirty to forty-five years of age the proportion was 14 per cent.

Certain presentations and positions create a liability to perineal tears; for example, presentation of the brow or unreduced occipito-posterior position. Excessive development of the fœtus or of part of it, whether physiological or pathological, may cause the injury; thus, in great size of the head or of the shoulders, or if there be hydrocephalus or ascites, or if the abdomen be enlarged from other cause, the perineum may be torn.

The perineum is most liable to be torn in its median line, because there the parts are thinnest in the distension occurring in labor, and farthest from the points of attachment.

While probably few obstetricians study immediately after labor injuries to the mucous surface of the perineum, the gynecologist meets with frequent examples of fissures thus caused, the cutaneous surface being quite normal. Duncan, who has given special study to this subject, states that he has seen no primipara without any injury, and none without a laceration posteriorly of the proper orifice of the vagina as distinguished from a laceration of the fourchette—that is, of the proper vulvar orifice. The fissures observed by the gynecologist upon the lower part of the vagina posteriorly are generally in the median line, though a tear having the form of a V or of a Y may be met with; while usually superficial, in some instances they are so deep that nothing of the perineum is left at this part but the skin. Again, there may be fissures upon the cutaneous surface formed when the perineum is greatly distended, the parts beneath the skin suffering no perceptible injury. Duncan,[2] who describes as partial central rupture of the perineum a split, crack, or tear of the skin of the perineum, also states that the injury may affect the vagina only; or it may affect the tissues between the vagina and the perineal skin, these two parts remaining entire; or, finally, it may affect skin and mucous membrane and the tissues immediately adjacent, while there remains entire some tissue intervening between the skin and the vagina.

When all the tissues of the perineum are torn, from the vulvar orifice to the anal sphincter, the laceration usually receives the designation of incomplete, and different degrees of such incomplete laceration have been distinguished and described; but such discrimination is not now necessary. If the injury should also include the anal ring, the rupture is called complete. The designation of complicated may be given to a rupture that extends above the rectal boundary of the perineum, thus involving more or less of the recto-vaginal wall; or there may be other vaginal rents, as in the case[1] reported by Gervis—an occipito-posterior position, delivery with the forceps; not only the perineum torn, but also a rent of the right lateral vaginal wall extending to the ischio-rectal fossa.

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[1] Marduel.

[2] *Op. cit.*

PROPHYLACTIC TREATMENT.—Saving the perineum from injury in childbirth has been the effort of obstetricians for ages, and from time to time different means have been employed or proposed for this purpose: the very multiplicity of means proves their futility in some cases; no universal prophylactic means has yet been found. The student of the history of these various means grows weary of vain repetitions[2] and of rediscoveries, and of the revival of plans that have been buried so many years, or even centuries, that they have been forgotten: here, as elsewhere in medicine, it may happen that the inventor devises that which was suggested and tried long ago, and he unconsciously repeats the thoughts and renews the methods of those who were dead before he was born. He is fortunate if he does not reinvent that which is only a few years old.

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[1] *St. Thomas' Hospital Reports*, 1874.

[2] This criticism, however, does not apply to the plan proposed by Dr. D. Berry Hart (*Transactions of the Edinburgh Obstetrical Society*, vol. xii., 1887). Dr. Hart asserts that the term "extension of the head," as the fourth consecutive movement of the labor mechanism, is a most misleading one, for it implies that the chin leaves the sternum while passing the perineum, and that during the anterior fixation of the occiput under the pubic arch antero-posterior and increasing diameters of the fœtal head form the antero-posterior diameters of the girdle of resistance. "I deny *in toto* that the chin leaves the sternum, and I hold that this fixation of the occiput and descent of the sinciput is not the best or normal mechanism. The best mechanism to avoid tear is for the occiput to lead, for the head to be driven on by a steady movement of translation, any rotation upon a biparietal axis so taking place as to favor occipital dipping and never dipping of the sinciput. It is easy to see how the erroneous idea of extension arose. The attendant while the patient lay on her left side watched the passage of the fœtal head from behind, saw more of the anterior portions of the head appear, and accounted for it by extension."

The following are Dr. Hart's directions for preventing tearing of the perineum: "With the patient lying, of course, on her left side, the attendant places the thumb of his right hand, guarded by a napkin soaked in hot sublimate, in front of the anus, and presses it gently there. The pressure is not in the direction of a line joining his thumb and the pubic arch, but nearly in the axis of the pelvic outlet. By this descent of the sinciput is hindered and that of the occiput favored. When the latter is beginning to pass under the pubic arch the fingers of the same hand are placed between it and the apex of the arch, so that when the occiput has cleared the arch the fingers are passed toward the nape of the neck, and the head thus grasped in the hand, the thumb lying over the sagittal suture. This gives one complete command over the head, which is now engaging in the diameters between the nape of the neck and forehead and face, and allows the whole passage with as little tear as possible."

Accepting Dr. Hart's teaching as to the mechanism of the escape of the fœtal head from the final boundary of the birth-canal, we have not only an important guide to the management of spontaneous, but of artificial—with the forceps—delivery of the fœtal head, so as to best protect the perineum from injury.

But are we powerless in the presence of the possibility of this accident, which is never so trivial that its prevention is a matter of indifference, and may be so grave that it brings immediate peril and may result in permanent distress? Knowing from the statistics of Schroeder and others that perineal laceration occurs more frequently if a woman be delivered upon her back than if she be upon her side, the obstetrician insists upon her occupying the latter position. Knowing, further, that rapid delivery, more especially in the primipara, is a frequent cause, he delays[1] the expulsion of the child until the parts of the lower portion of the birth-canal, having undergone their physiological softening and stretching, heretofore mentioned, have become dilatable. He corrects, if possible, a brow presentation or an occipito-posterior position. A hydrocephalic head should be punctured, and even, the child being dead, its head or trunk ought also to be lessened in size if the perineum is liable to tear, in order that delivery may occur: better mutilation of a dead child than a serious tear of the perineum of a living mother. Yet cases do occur in which the vulvar ring dilates to a certain degree, and then the process ceases before the dilatation is sufficient for birth; here the remedy is episiotomy: the cases are rare that require this operation, but every practitioner of a few years' experience has met with them.

But notwithstanding all prophylactic means, there are cases in which the perineum must tear, will tear, the tissues giving way under a moderate strain almost as readily as a piece of wet blotting-paper, especially if they have been subjected to continued pressure. Fortunately, however, such cases are quite exceptional.

TREATMENT OF ACTUAL TEARS.—In case of central perforation, the head partially making its way through the rent, division of the anterior bridge is at once indicated, as has been before stated, thus converting the exceptional into the ordinary injury. This conversion may occur spontaneously, but, on the other hand, there is the risk of a tear through the posterior bridge—that is, through the anal ring—which would be a greater misfortune. After the labor is over closure of perineal wounds, except superficial ones, is clearly indicated: an exception may be made if the tissues have been greatly bruised and sloughing is probable. The material for sutures may be of catgut, silkworm gut, silver wire, silk, or of horsehair. If internal stitches are necessary, whether at the vaginal or the rectal surface, or at both, catgut is to be preferred and the continuous suture is best. My own preference is for silkworm gut for the external sutures. The woman lies upon her back, the lower limbs strongly flexed; the parts are thoroughly cleansed by a hot antiseptic solution, and a sponge is passed into the vagina above the rent, so as to absorb the uterine flow and prevent its obscuring the parts to be stitched: hemorrhage from the wounded perineum is in some instances so great that ligation of one or more bleeding vessels is necessary. Such great bleeding occurred in three cases after episiotomy had been performed by Depaul, and in one of these a ligature was required for its arrest. Before introducing the stitches the obstetrician cuts off with scissors any loose pieces of tissue, and thus prepares the surfaces of the wound for being brought in accurate apposition. The stitches having been introduced and tied, the vaginal sponge is removed, and the parts again cleansed with an antiseptic solution, iodoform sprinkled upon the external surface of the perineum, and a suppository of iodoform introduced into vagina; the patient is allowed to lie in such position as is most comfortable, and the knees are not bandaged together. For many years I have protested against this confinement of the lower limbs after perineorraphy or perineoplasty as an unnecessary cruelty, and as tending, in case of the former rendered necessary by childbirth, to imprison the lochial discharge; by no probable movements of these limbs can the patient put any strain upon the parts that have been stitched together. As to evacuations from the bowels, while some restrain these for a week or ten days, other practitioners prefer to have them occur two or three days after the delivery, and subsequently once in one or two days: the practice of the latter is probably the better. As to the removal of the stitches, of course those of catgut require no attention, for they are absorbed in six to eight days, in some instances unfortunately sooner; sutures of silkworm gut, of silver wire, or of horsehair may be left for ten days or two weeks, or even for a longer period.

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[1] This delay may be effected by direct pressure of hand or fingers upon the fœtal head, or it may be restrained with the forceps; by controlling voluntary efforts of the parturient by direct command or by the administration of chloroform by inhalation, and such inhalation may lessen uterine action also.

In regard to superficial tears, whether of the mucous or of the cutaneous surface of the perineum, the careful and constant use of antiseptic applications during their healing is imperative, and constitutes, in fact, the only treatment required.

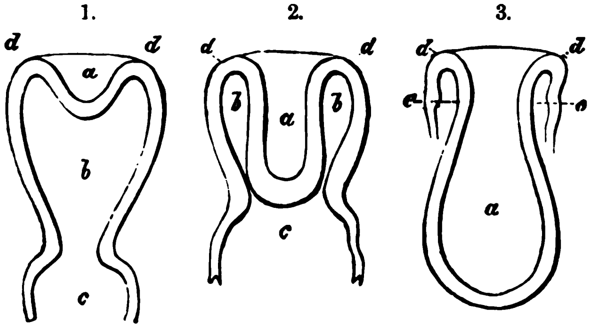
INVERSION OF THE UTERUS.

Inversion of the uterus is the gravest displacement of this organ that is possible. Fortunately, it is not a frequent accident, statistics showing that it does not occur oftener than once in one hundred and forty thousand deliveries. An inverted uterus has been compared to the finger of a glove turned inside out, and the disorder has been described as a hernia of the uterus through the os; Paré applied the term "perversion" to it—a word which Crosse in his well-known monograph[1] used to designate the final degree of this displacement: if the inversion be complete, the simplest statement of the condition is, The uterus is upside down and wrong side out. Denuce[2] attributes the first recognition of inversion of the uterus to Hippocrates, who also directed a plan for its restoration; he quotes, too, a passage from Aretæus, who not only described the accident, but also referred to traction upon the cord as one of the causes, this traction being made in an effort to remove an attached placenta: so, too, subsequent great lights of ancient medicine, as Soranus, Moschion, Galen, Paul of Ægina, and others, have referred more or less distinctly to inversion of the uterus as an accident of childbirth.

Two conditions of the uterus are necessary in order that it can become inverted—increase of the cavity and relaxation, either general or limited, of the walls. These conditions are presented by the uterus in pregnancy and in labor, but they may also occur if the uterus be distended from other cause than an ovum; as, for example, by a polypus. In 400 cases of this accident collected by Crosse, only 50 occurred independently of pregnancy: most of the 350 thus connected with gestation occurred at its conclusion, only a very few happening after abortion.

In this article the inversion occurring in connection with childbirth will alone be considered, for that variety which is connected with certain intra-uterine tumors belongs to a treatise upon diseases of women:

FIG. 3.



Three Degrees of Inversion: 1, depression; 2, introversion; 3, complete inversion (Crosse): a, fundus of uterus; bb, cavity of uteri receiving inverted fundus; c, vagina; d.d, mouth of inverted portion.

for the same reason the treatment required in acute puerperal inversion will be presented, and that of chronic inversion omitted.

The uterus when inverted forms a cavity lined with serous membrane and opening into the abdomen; according to the degree and the recency of the inversion this newly-formed cavity will contain part of the oviducts, of the round and of the broad ligaments, and in some instances the ovaries and loops of intestine. Three degrees of inversion are described. In the first the fundus is depressed, a cup-like cavity being formed which may be felt from the abdominal wall; in the second the fundus has descended to the internal os uteri, the entire body of the organ thus participating in the displacement; in the third degree the fundus and the body have passed out of the os: in the last case the uterus may pass out of the vulva and be external, the vagina necessarily undergoing partial inversion, and then there is prolapse of the inverted uterus.

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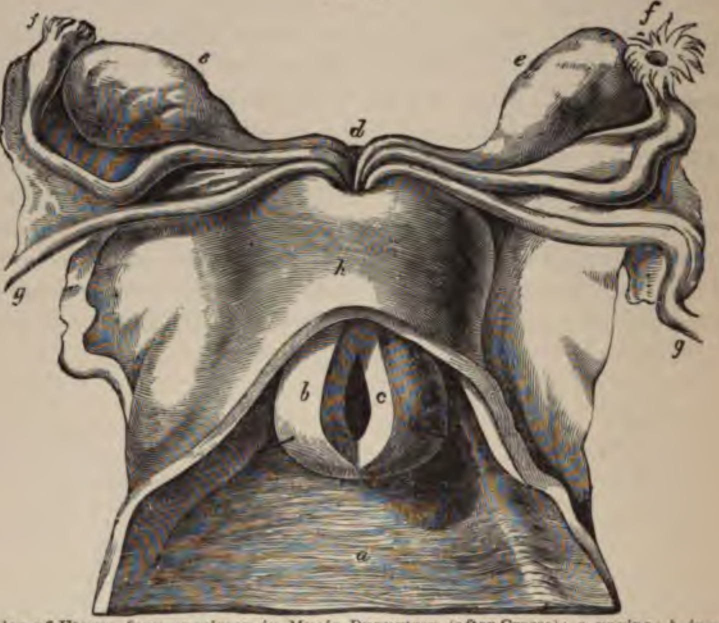
[1] "Essay upon Uterine Inversion," *Transactions of the Provincial Medical and Surgical Association*, London, 1844 and 1847.

[2] *Traité clinique de l'Inversion uterine*, Paris, 1883.

FIG. 4.



Inversion of Uterus, from specimen in Musée Dupuytren (after Crosse): *a*, vagina; *b*, inverted fundus, incised at *c* to show its cavity; *d*, point of inversion, with round ligaments, tubes, and ovarian ligaments drawn in; *ee*, ovaries; *ff*, fimbriated ends of tubes; *gg*, round ligaments; *h*, cervix covered by peritoneum.

CAUSES OF UTERINE INVERSION.—Remembering that the first degree of this disorder consists in a depression of the uterine wall at its upper portion—a cupping of the fundus, as it is sometimes called—this depression may result from intra-uterine traction or from extra-uterine pressure. Either traction or pressure may be spontaneous or artificial; the resulting inversion may be complete or incomplete.

Pulling upon the cord for the delivery of the placenta was, as has been previously stated, recognized by Aretæus as one of the causes of uterine inversion, and probably it is the most frequent cause. The scepticism as to this being common manifested by one of the wisest of American gynecologists, Dr. Emmet, upon the ground that such delivery of the placenta is so common on the part of ignorant midwives, and therefore the accident ought to be much more frequent, is not well founded. Certain conditions must be present in order that traction upon the cord may invert the uterus, and among these are a firm attachment of the placenta and uterine relaxation: the usual absence of these conditions explains the rarity of the accident.

One of the most remarkable cases of uterine inversion caused by pulling upon the cord has been recorded[1] by an American physician, Dr. Woodson of Kentucky: A negress four months pregnant was taken with severe uterine pains in a bath; she succeeded in seizing the fœtus and dragged it out, inverting the uterus. Relative or absolute shortness of the cord has in several instances been followed in spontaneous delivery by inversion of the uterus: Baudelocque has given two examples. So also delivery with the forceps has in a similar condition of the cord caused the accident: illustrative cases are given by Levret and Böckendal.[2] The cord may be normal in length, but from the unusual position occupied by the woman during the expulsion of the child the uterus may be inverted by the weight of the child dragging upon or suspended by the cord. Daillez reported the following case: A girl eighteen years old, near her labor, was driven from home by her father; she took refuge in the house of a friend, and soon felt the pains of childbirth. An accoucheur called to her thought that she was suffering with false pains, and went away; upon his return he found her dying, the uterus completely inverted and hanging between her thighs; he learned that the unfortunate girl was delivered standing, her elbows resting upon the back of a chair; the child suddenly escaped and the cord was ruptured. The traction upon the uterine wall may be made by the partially-detached placenta and clots of blood; thus, Kormann[3] quotes a case from Dr. Camillo Fürst in which the accident occurred from the weight of a mass of blood resulting from a partial separation of the placenta retained by adherent membranes.

The inversion may be caused by extra-uterine pressure. This pressure may be manual or abdominal. The former may be made in improper efforts exercised to effect the delivery of the placenta by the so-called Credé's method. But abdominal pressure, there being no manual interference whatever, may cause the accident. Denuce quotes from Galen the following remarkable passage, showing how this great master recognized this cause of uterine inversion: "Under the influence of the power of expulsion, which is the opposite of the power of retention of which we have spoken, the mouth of the womb opens, and the entire fundus of this organ so far as possible approaches it, pushing the fœtus out. At the same time as the fundus of the uterus, the parts that surround it, the abdominal walls, which are the external walls of the instrument of expulsion regarded in its whole, pushing by the action of all their forces, strongly clasp the fœtus and force all out. This part of the action, which is under the woman's control, resides not in the uterus, but in the abdominal muscles, which come to her aid as they do in defecation and in urination. Also in some women, when this expulsive power is exerted immoderately, the violent pains may drive out the uterus itself. The accident is entirely similar to that which occurs in a struggle or combat, when one of the contestants, forcing the other backward, throws him upon the ground, at the same time falling on him. Thus the uterus, when it violently expels the fœtus, may itself be at the same time precipitated without, especially if the ligaments which fasten it in the basin are previously relaxed."

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[1] *American Journal of the Medical Sciences*, 1860.

[2] See Denuce.

[3] *Op. cit.*

Paralysis of the placental site or general atony of the uterus is a condition which permits inversion of the uterus by abdominal pressure. Supposing the portion of the uterus corresponding with the place of placental attachment to be paralyzed, there may follow, either with or without abdominal strain, dropping down of this part into the grasp of non-paralyzed but active muscular walls of the uterus; these, therefore, receiving the introcedent mass actively contracting, may make the inversion complete. John Hunter, in describing an inversion of the uterus caused by a polypus, observed: "I conceive the contained or inverted part becomes an adventitious or extraneous body to the containing, and it continues its action to get rid of the inverted part, similar to an intussusception of the intestine." Barnes, in referring to Hunter's description, states that it contains the germ of most subsequent theoretical explanations.

Professor Isaac E. Taylor holds that sometimes inversion begins at the cervix, this part undergoing eversion as in prolapsus, and this going on to complete inversion of the organ. Denuce considers this prolapse which Taylor refers to as connected with the precise moment of evolution of partial inversion where the uterine depression, forced by uterine or abdominal contractions, escapes the orifice of the neck and is gradually transformed into an incomplete inversion appreciable in the vagina and between the lips of the neck.

Duncan[1] recognizes four kinds of uterine inversion occurring after delivery: 1, spontaneous passive uterine inversion; 2, artificial passive uterine inversion; 3, spontaneous active uterine inversion; and, 4, artificial active uterine inversion. "The only uterine condition essential to the production of all these kinds is paralysis or inertia or complete inaction. This is the condition of the whole organ at the time of production of the first two kinds. In the last two kinds it is accompanied by uterine activity, and, as these cannot coexist in the same part, the paralysis is partial and the activity partial. Action of the uterine wall cannot cause introcession of it. Activity of the whole of the uterus renders inversion impossible. Activity of a part of the uterus renders introcession of that part impossible. There must therefore be paralysis of the whole or of a part before inversion can begin."

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[1] *Researches in Obstetrics*, Edinburgh, 1868.

SYMPTOMS AND DIAGNOSIS.—Pain, shock, and hemorrhage are the chief symptoms of sudden and complete inversion of the uterus. The woman in many cases cries out with the suffering; she declares, if the inversion rapidly occurs as a consequence of traction upon the cord, that her intestines are being torn away. The shock is partly the expression of this acute suffering, partly the sudden withdrawal from the abdomen of one of its largest organs; and should serious hemorrhage occur, the loss of blood contributes to it. The face is pale, the expression anxious, the pulse frequent and feeble, the limbs cool, and there may be vomiting and also convulsions. The hemorrhage may be slight, for if the placenta be entirely adherent to the uterus, there can be no considerable bleeding; if, however, it be completely or partially detached, the flow may be very profuse and prove fatal in a short time. But there may be little or no bleeding, yet the collapse be profound. "Symptoms of incarceration may and frequently do arise when coils of intestine have entered the funnel formed by the inverted uterus and have become compressed."[1]

Abdominal examination shows the absence of the uterine globe, and a tumor occupying the vagina, or even chiefly projecting from the vulva, is found. This tumor may have the placenta still attached, and then an error in diagnosis is impossible. If the placenta has been cast off, the obstetrician possibly doubts whether the tumor found in the vagina or at the vulva be an inverted uterus or a polypus, retention of urine being a common consequence of inverted uterus, and a distended bladder may simulate the uterus; therefore, let him who has not witnessed the accident, but who first sees the condition hours or a day or two after its occurrence, begin by using a catheter. No confusion from this cause, and no error in diagnosis thence derived, a bimanual examination, the impossibility of passing a uterine sound into the uterine cavity if the organ be inverted, and ascertaining that the point of a sound passed into the bladder may be felt in the median line by two fingers in the rectum too distinctly to suppose that the uterus intervenes, will leave no doubt in the mind of the careful examiner. I have been called to three cases of inversion of the uterus, and I have not in one of them found the organ the seat of intermittent contractions; yet such contractions have been brought forward as one of the means by which the inverted uterus can be distinguished from a uterine polypus. So, too, I utterly reject dependence upon the sensitiveness of an inverted uterus as a means of diagnosis: many years ago in a case of doubtful vaginal tumor I held in my hand that which by other means was proved to be the inverted uterus, and, watching the face of the patient, made two or three punctures of the tumor with an exploring-needle, and there was not the slightest shade of suffering passed over her countenance coincidently with a puncture. The two signs that have just been mentioned, though indorsed by high authorities, may possibly in some cases be valuable, but as a rule I believe they will prove doubtful or even deceptive.

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[1] Kormann.

In rare instances inversion of the uterus has occurred some days after labor. It is most probable, however, that in such cases there was already an unrecognized partial inversion, beginning at or soon after delivery, which under the influence of contractions was converted into a complete condition.

PROGNOSIS.—Acute puerperal inversion of the uterus is a condition of immediate and great peril. Even though restoration of the organ be promptly accomplished, death may follow, as in a case reported by Breus.[1] Crosse's statistics show that of 109 patients who died, a fatal result occurred in 79 within a few years, in 8 at the end of a week, and in 6 after a month. If the unhappy victim has escaped death from shock or hemorrhage, sloughing of the uterus in consequence of constriction by the neck may bring a fatal issue early in the puerperal period. Spontaneous restoration of an inverted uterus even months or years after the accident has occurred in very rare instances, but the probability of this event is too slight to sustain a rational hope.

TREATMENT.—Immediate restoration of the organ to its normal place is indicated, and the sooner after the accident the effort is made the greater the probability of success. Supposing the placenta to be still attached,[2] the obstetrician grasps the uterus in his hand—antiseptics being used, and if the patient's condition does not forbid anæsthesia is employed—presses the organ upward, being careful to avoid the sacral promontory, and at the same time with the other hand counter-pressure is made through the abdominal wall; and possibly the fingers of this hand may be usefully employed in overcoming the resistance of the entrance to the uterine cavity now opening into the abdomen. The fingers of the hand which holds the uterus may be usefully employed in dilating the ring-like cervix, while the palm presses the uterus against the resisting cervix. It will be observed that in this manipulation the taxis is peripheral, and the effort is made to restore first that part of the uterus which came out last. Another mode of restoration is by pressure directly made upon the fundus: this pressure is usually made by the fingers of one hand brought together in the form of a cone: of course the finger-nails are short; the attempt is made to depress that portion of the uterus against which the fingers push, and thus begin the restoration. The taxis in this case is central, and the part of the uterus restored first is that which came out first. The third method is that first suggested and successfully employed by Noeggerath, and consists in pressure upon one side of the uterus at a point corresponding with the entrance of an oviduct, indenting or depressing the surface there, and thus starting the restoration: this method has been called that of lateral taxis.

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[1] *Wien. med. Woch.*, 1882.

[2] Obstetricians are not agreed as to whether the placenta should be removed, provided no separation has begun, before restoration of the inverted organ is attempted. The argument in favor of its removal first is that this can be much more readily accomplished before than after the reduction, and that reduction will be more readily accomplished without than with the placenta. The argument against it is that thereby hemorrhage is at once caused; possibly, too, we are less liable to injure the uterine walls by pressure with the cone-formed fingers or with the fist, when these walls are in part protected by the intervening placenta.

After the restoration of the uterus by one or the other of these plans, the hand, of course being in the uterus at the completion of the reduction, is used to detach the placenta and to stimulate, the external hand assisting, the uterus to contract. Barnes says care should be taken to avert what has happened, reinversion, and for this purpose he directs passing along the palm of the hand a uterine tube connected with an injecting syringe and throwing up a pint of hot water, 110° Fahr. If the placenta be found partially separated before restoration of the uterus is attempted, the separation ought first to be completed.

If the physician is not called to the patient until several hours after the accident, or if previous efforts have been made without success, should he at once attempt the reduction? The answer depends upon the condition of the uterus: if it is not inflamed and very sensitive, and if it is relaxed, gentle efforts at restoration may be made even though a day or two has passed. Atthill[1] takes the ground that if an effort at reduction has not been made within twenty-four hours after labor, it is better to wait until after uterine involution has been completed before attempting restoration. The reason for this delay is that the uterine tissues during involution are more liable to be lacerated in the manipulations made in reduction.

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[1] *Diseases of Women*, Dublin, 1880.

HEMORRHAGE DURING AND AFTER LABOR.

Hemorrhage as a complication of childbirth is dependent upon different causes: it may be uterine, vaginal, or vulvar. During the first stage of labor, dilatation of the os uteri, it can only occur in case the placenta is partially or completely detached, and hence uterine vessels at its site are ruptured. In the second stage of labor hemorrhage from tears of the neck of the uterus or from those of the vagina is usually prevented by the pressure of the child completely filling the birth-canal in its descent. Bleeding from these injuries, as well as from those of the vulva and perineum, immediately follow the birth of the child. The most frequent cause of bleeding in the placental period of labor and afterward is atony of the uterus.

In considering the subject of hemorrhage arising from placental detachment in the first stage of labor two divisions are necessary: first, bleeding when the placenta is prævia; and, second, when the placenta occupies its normal position. The first is commonly known as unavoidable—a term which it will be seen needs to be qualified—and the second as accidental hemorrhage.

Placenta Prævia.—Dr. Edward Rigby, in his valuable essay[1] published more than a century ago, spoke of the placenta as prævia when "it is fixed to that part of the womb which always dilates as labor advances." If we compare this with the definitions given even in recent years, we find that in a clinical point of view nothing has been added to or otherwise essentially changed in it. Spiegelberg has said[2] that the placenta is prævia if a greater or less part of it is situated in that part of the lower uterine segment which must be stretched in labor; this part of the uterus is compared to the segment of a hemisphere which during parturition must be converted into a cylindrical canal. Zweifel says:[3] "The lower uterine segment represents a funnel; the narrowed internal orifice corresponds with the internal os. When the child has to pass this part, when the lower uterine segment is stretched and dilated, the funnel gradually takes the shape of a cylinder. The circular fasciculi around the internal os, which formed a ring before it was opened with a diameter only equalling some lines, during the passage of the child's head has a diameter of eight to eleven centimeters. Thus each circle must be expanded, and the whole tissue of the lower uterine segment becomes very thin. The expansion is not only circular, but also longitudinal. If the placenta is attached in this lower uterine segment which undergoes such important changes during the dilatation of the os, it must become loosened from its attachment."

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[1] *An Essay on the Uterine Hemorrhage*, etc. The first edition of this work was published in 1776.

[2] *Op. cit.*

[3] *Op. cit.*

Forty years ago Barnes first sketched his theory of placenta prævia, and since that period has repeatedly pressed it upon professional attention, the last being in a communication[1] made to the British Medical Association. He divides the uterus into three zones—viz. a fundal, an equatorial, and a lower zone; the superior boundary of the last he called (1847–57) Barnes' boundary-line, "since then sometimes called Braune's os internum, Bandl's ring, or Schroeder's contractions-ring." For him, even if a part of the placenta is attached in the lower zone, there is one of the varieties of placenta prævia, while the grave form occurs when all or the greater part of the placenta grows within this zone. Hart[2] gives the following definition of placenta prævia: "The placenta is prævia when attached in part in the lower uterine segment—*i. e.* when it is attached to that portion of the uterine body where the peritoneum is separable. We might also define the placenta as prævia when so placed that a part of it, during labor of course, falls below the contraction-ring."

Frequency and Causes.—Rigby states that of the 108 cases of flooding presented in his volume, "42 were produced by a separation of the placenta, occasioned by its being situated on the os uteri." If the general practitioner met with this condition one-fourth as often as Rigby did, the frequency of placenta prævia would be very great. But this is not the fact. Still, there are wide differences between the statements of different authorities. Johnson and Sinclair found 1 case of placenta prævia in 573 deliveries; Hecker,[3] 42 cases in 17,220 deliveries, or 1 in 410; Galabin, Guy's Hospital Lying-in Charity, 1 in 575; the combined statistics of Schwartz, Schwörer, Hegar, and Spiegelberg, as given by the latter, embrace 572,120 deliveries, in which there were 62 cases of placenta prævia, or 1 to 852; Spiegelberg regards the proportion as 1 in 1000. From the combined statistics of Schwartz, Arneth, Klein, Collins, McClintock, and Hardy, with those of the Wurzburg Maternity and the Paris Hospital of Clinics, embracing nearly 600,000 cases, I find the proportion of cases of placenta prævia 1 to about 1200.

Ambrose Paré (1575) referred to descent of the placenta before the child—*filius ante patrem* the condition was called—as very dangerous for the mother, and as a certain indication of the death of the child, but was content with the belief, then and for a century afterward generally accepted, that the placenta occupied this unusual position because of its premature detachment and falling down to the mouth of the uterus. When, however, Gottlieb Schacher, professor of obstetrics

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[1] *Brit. Med. Journ.*, March 3, 1888.

[2] *Trans. Edinb. Obstet. Soc.*, vol. xii., 1887.

[3] *Beobachtung und Untersuchungen aus der Gebäranstalt zu München umfassend den Zeitraum 1859–79.* By Dr. Carl von Hecker, Munich, 1881.

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in the University of Leipzig (1709), made the first anatomical demonstration, by the autopsy of a woman who perished of hemorrhage at the end of her pregnancy, that the placenta was attached over the os uteri, the membranes being unruptured and firmly united to the uterus, many curious explanations of the phenomena were suggested. Epidemic influence was invoked by some, just as until quite recently reputable authorities found in this occult and unknown agent the cause of puerperal fever; Schurigius attributed it to coition in the erect posture; and Osiander held that if a woman just after sexual intercourse sat up the accident would occur, and therefore advised that she should remain some time upon her back or upon one or the other side: in the one case the placenta would be grafted upon the fundus, and in the other upon the side of the uterus corresponding to the side of the body upon which she was lying. Still other causes suggested were the great specific gravity of the ovum and the fecundation of the ovule in the uterine cavity.

Placenta prævia is at least six times more frequent in multiparæ than in primiparæ; there is also a liability to it caused by pluriparous pregnancy. It is more frequent in the poor than in the rich, as Spiegelberg suggests, because of hard work in the early part of pregnancy, or more probably from subinvolution of the uterus: rapidly recurring pregnancies create a predisposition to it, and so too its previous occurrence. Ingleby has reported two remarkable cases, in each of which recurrence of placenta prævia seemed dependent upon the entrance of the tubes near the internal os. Abnormal size of the uterus, diseased condition of its lining membrane, and spasmodic contractions have also been given as causes.

Quite recently Mantel[1] has shown the frequent association of polyhydramnios and placenta prævia, the former, however, according to his view, being the consequence in these cases of the former.

Varieties and Symptoms.—If the centre of the placental disk corresponds with the internal os uteri, the condition is known as central or total placenta prævia; if the os uteri is only covered in part, the term partial is used; if the margin of the placenta is at the margin of the os, the attachment of the former is said to be marginal; while if the placenta does not extend as low as the os, but still is partially within the lower uterine segment, the implantation is called lateral. Considerable latitude must be given to the term "central," for even though the os be completely covered by placental tissue, it is very rare indeed that the distance from the os to the placental margin is the same on each side: in the great majority of cases the membranes can be more readily reached by the finger passing up on the right than upon the left side of the uterine cavity; and this is a fact oftentimes of great practical importance. The term "total" is preferable to "central." With the modification which has been suggested of the designation "central" or replacing it by "total," there is no necessity for retaining the term "partial," so that the varieties may be reduced to three—viz. central or total, marginal, and lateral. Zweifel regards any classification as incorrect, partly on the ground that with the membranes unruptured more and more of the placental tissue protrudes in consequence of the retraction of the os uteri. But when we consider that the danger and the difficulty of treatment are much greater in case of total than in lateral implantation of the placenta, the retention of these terms seems necessary.

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[1] *Archives de Tocologie*, 1888.

Total or central implantation of the placenta is the least frequent, and lateral the most frequent.

Hemorrhage is the most important and characteristic symptom of placenta prævia. This hemorrhage may occur in pregnancy or not until labor begins, and it was to the latter form that Rigby, as we have seen, gave the name of "unavoidable." Nevertheless, it has not been uncommon to accept as unavoidable also the hemorrhage in placenta prævia occurring prior to labor. Admitting the fact, the explanations offered[1] were two: the first was that of Jacquemier, who attributed the necessary detachment of the placenta, explaining the hemorrhage, to a more rapid development of the uterine wall than of the placental tissue; on the other hand, Legroux claimed that the placenta extended itself more rapidly than the lower portion of the uterus to which it was attached: according to the one hypothesis the uterus grows away from the placenta, and by the other the placenta grows away from the uterus, but in either case there is a loss of relation between the placenta and the uterus, and necessary separation occurs, and therefore the hemorrhage is unavoidable. Further, if, as has been claimed by many obstetric authorities, there be in the latter weeks of pregnancy a gradual change in the neck of the uterus, so that the cervical cavity is dilated in order to contribute to the lower uterine segment, thus furnishing increase of space for the growing ovum, hemorrhage must necessarily occur, for all dilatation of the internal os must cause separation of the placenta attached over or close to it. But this view is not now generally accepted. Dr. Isaac B. Taylor has recently[2] reiterated his statement, first made in 1852, and since that time more than once repeated, that the cervix remains unchanged during gestation. His statement is this: "As far back as January, 1852, I recognized from my clinical observations, instituted from a different method of investigation than the touch alone, that the cervix uteri did not undergo any change whatever to coalesce or become absorbed into the body of the uterus during the progress of gestation, but that it remained intact, and was not used up in the general enlargement of the uterus which takes place during pregnancy to accommodate the growing child." He further states that his conclusion as to the cervix remaining unshortened during pregnancy rests upon the examination of 3000 cases. It is obvious that if the statement of Stoltz as to the shortening of the cervix being a normal phenomenon of the last two weeks of pregnancy, and still more that of some other authorities that the uterine portion of the cervix during the last three months is gradually expanded so that it contributes to the cavity of the body of the uterus, be correct, hemorrhage in placenta prævia would inevitably occur during this change. But repeated observations establish the fact that in some cases of placenta prævia hemorrhage in pregnancy has not been observed.

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[1] *Placenta Prævia*, by Auvard.

[2] *Transactions of the New York Medical Association*, 1887.

It must be admitted, however, that while growth of uterus or of placenta is not admitted as a cause of premature placental detachment and consequent hemorrhage, there is a loss of relation between the placenta and the uterine wall resulting from the continuous distension of the lower uterine segment. Pinard[1] explains the absence of hemorrhage or of premature rupture of the membranes in such cases as resulting from resistance of the membranes, from resistance of the placenta, from the presentation of the fœtus, and the circumstances which prevent the localized pressure and distension occurring up to the time of labor when other factors are concerned. But no matter what hypothesis is held as to the cause of hemorrhage during pregnancy when the placenta is prævia, the bleeding not occurring in all cases cannot be justly termed unavoidable; and some call it also accidental—a term which has generally been limited to hemorrhage consequent upon the premature detachment of the normally-situated placenta. It probably would correspond more accurately with facts to state that in some cases of previous placenta the hemorrhage is unavoidable and in others accidental. The position of the placenta creates a greater liability to the accident; in some cases "the insults of coition," and in all the greater blood-pressure, may be regarded as important factors in promoting premature partial detachment, and consequent hemorrhage. Abortion, as has been stated, may be the consequence of this ectopic development of the placenta; premature labor for like reason may thence result; and Spiegelberg has wisely remarked that even the hemorrhages which occur during the latter months of pregnancy depend upon commencing labor, and that it is not the hemorrhages which induce premature labor, as is generally supposed, but that the converse relation is true.

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[1] *Le Col et le Segment inférieur de l'Utérus a la fin de la Grossesse pendant et apres le Travail de l'Accouchement*, par H. Varnier, Paris, 1888.

In general, the hemorrhage in placenta prævia prior to labor occurs in the last six weeks of pregnancy. In total placenta prævia, accepting Zweifel's statement, it takes place first between the twenty-eighth and the thirty-sixth weeks, but in lateral first after the thirty-second week. In some cases of lateral insertion there is no hemorrhage during pregnancy. The bleeding may follow exertion, such as lifting, straining at stool, etc.; but often there is no exciting cause obvious, and the flow has begun, for example, when the woman was resting quietly in bed; possibly while sleeping a gush of blood has taken place. The loss of blood in the first attack may be so great as seriously to exhaust the patient, but usually no such grave result is observed; the subsequent attacks are, however, as a rule, more severe. Dilatation of the os proceeds as hemorrhage increases in frequency or in quantity, yet there are exceptions, for there may be a fatal flow of blood with the os only slightly open, as in a case[1] reported by Ingleby which he did not see until just after death, and he found the os so little dilated that the introduction of two fingers was barely possible. Rigby[2] mentions a case of flooding to which he was called, the woman, who had been bleeding for two hours, dying soon after he entered the room. The uterus was very little open, and he could not feel the placenta. He opened the body the next day: "the placenta was upon the os uteri, and a partial separation of it, no bigger than a crown-piece, was the cause of this fatal hemorrhage."

The hemorrhage has its origin from detachment of that part of the placenta at or nearest the internal os, and it continues, uterine action being presupposed, until the os is sufficiently dilated to permit the passage of the fœtus: when this needful stretching has been attained, no further detachment of the placenta is necessary, and so no more adhesions of the latter to the uterus are ruptured. But meanwhile retraction or pulling up of the os, through the action of the fundus and body of the uterus, goes on, the lower segment of the uterus being, as it were, passively stretched, but also the os dilated and caused to ascend over the ovum. Barnes says: "The form of contraction that prevails in the lower zone is retraction. Longitudinal muscular fibres are continued from the middle zone along the walls of the lower zone, even into the cervix and vagina. Their action is to pull up or retract the lower zone, opening the cervix, thus aiding the driving power of the body of the uterus and the abdominal muscles in canalizing the passage and forcing the fœtus through it. When this retraction is retarded, there is hemorrhage; when retraction goes on well, hemorrhage ceases." This view is of great importance, and will be referred to in connection with the treatment of placenta prævia. It is hardly necessary to state that the bleeding is not from the placenta, but from the uterus.

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[1] *Clinical Lectures on Diseases of the Puerperal State.*

[2] *Op. cit.*

The DIAGNOSIS of placental presentation will be made by uterine hemorrhage often occurring without obvious cause, and suddenly, and the flow being more or less profuse, and placental tissue may be felt by the finger introduced into the os uteri.

PROGNOSIS.—This is very grave for the mother, and especially grave for the child. Spiegelberg regards the maternal mortality, including deaths from puerperal disease, as 30 per cent. Zweifel attributes the increased liability to septicæmia of a woman who has had placenta prævia to the anæmia resulting from the hemorrhages, this anæmia leading to extensive formation of thrombi, and probably to more ready absorption. But probably the chief reason for this greater liability is found in the manipulations required, in the traumatism, and in the readier access of air during the treatment of the condition: the greater relative frequency of shoulder presentations also renders necessary obstetric manipulation. Yet there are some circumstances which materially alter for the better the prognosis. The variety of placenta prævia is an important element. Thus, Depaul's statistics include 25 cases of central insertion, with 14 deaths; 31 of partial, with 3 deaths; and 15 of lateral, with no death. Much depends upon the woman having prompt and proper care, upon the early recognition of the condition, and upon the treatment employed. There is a greater liability to hemorrhage during the delivery of the placenta, and also subsequently, the lower segment of the uterus not contracting so well as the upper portion. Hecker, out of 42 cases—29 lateral, 11 marginal, and 2 central—of placenta prævia, lost 16, 7 per cent.; Spiegelberg's mortality was a little less than 16 per cent., and Barnes' 9 per cent.

The prognosis as to the child is even much worse than that as to the mother. The fœtal mortality rarely falls under 50 per cent., and in some statistics rises to 70, or even to 75 per cent., and even higher. In Spiegelberg's experience it was somewhat over 50 per cent.; Barnes puts it at 64 per cent., and Schwartz at 75 per cent.; Hofmeier, 63 per cent.; Behm, 83.4 per cent., etc. The child perishes from asphyxia, not from hemorrhage.

Shoulder presentation is very frequent. Depaul's statistics show that it occurred once in 9 cases. Charpentier in 1148 cases of placenta prævia found this presentation in 24 per cent., and Lomer in 32 per cent. From the attachment of the cord being frequently marginal, its prolapse is not infrequent, and hence increased danger to the child: the frequency too of a transverse position of the child also predisposes to this prolapse.

TREATMENT.—This ought to be such as will secure the least maternal and the least fœtal mortality. While, of course, the life of the mother is of the greater importance, yet it is a mistake to ignore all consideration of the life of the child. Dr. Barnes has recently said: "It is no longer permitted to us, without ample proof of clear necessity, to sacrifice the child in order to save the mother. The cases in which the two lives are supposed to stand in antagonism are vanishing before the light of modern science and skill. And in no conjuncture is this more true than in the treatment of placenta prævia." With him I must enter my protest against the teaching of those who openly avow the life of the child is not to be considered, and we should only seek to save the mother.

Now, at least some of the methods that have been advised are attended with very great fœtal mortality, as will be seen, and therefore should be carefully considered before being generally adopted. In case of hemorrhage during pregnancy in consequence of the placenta being prævia, the question of active treatment will be determined by the amount of the flow and also by whether the fœtus is yet viable. If the flow be slight and the fœtus not viable, there is no demand for active interference. It should be remembered that it is not always, even in central placenta prævia, that either the life of the mother or the nutrition of the fœtus is interfered with. Kormann advises absolute rest in a horizontal position, and cold water, ice water, vaginal injections; and only in cases where this treatment does not arrest the bleeding which involves danger to the life of the mother is the artificial interruption of pregnancy brought into consideration. Spiegelberg states: "If the hemorrhage is only moderate in quantity, whether distinct pains are present or not, a purely expectant attitude should be adopted, much as is recommended in the case of similar hemorrhages due to abortion; there is at least room for hope that even when the bleeding has begun before the natural end of pregnancy, the latter may continue for a while uninterrupted. This treatment is further recommended by the fact that under the existing circumstances the diagnosis is not, as a rule, quite certain; but the patient and her friends should have their attention called to the condition, and be urged to call in assistance as soon as any unfavorable circumstances show themselves." The teaching of Depaul was similar: "When the hemorrhage begins before labor the treatment does not differ from that used in general for losses of blood occurring in pregnancy: So long as the loss is slight, either in quantity or in duration, we should employ general means—the horizontal position, the hips elevated, cold applications upon the upper part of the thighs and upon the lower part of the abdomen, cold injections in some cases, slightly acidulated drinks, etc."

Nevertheless, if there is serious hemorrhage after the fœtus is viable —and it is rare that such hemorrhage occurs before—the induction of premature labor is indicated; often, indeed, as Spiegelberg has stated, the hemorrhage is caused by premature labor, and the obstetrician simply assists nature's efforts. Statistics prove that both the maternal and the fœtal mortality are greater if labor occurs at term than if it be premature, and hence a strong argument in favor of the practice is given. Some of the highest obstetric authorities have pronounced in favor of this treatment. Dr. Thomas, for example, who in 1870 first wrote in advocacy of it, has recently said: "After a large experience I unhesitatingly range myself among the strong advocates for the prophylactic treatment of placenta prævia by premature delivery."[1] Murphy has for some years followed this practice, and his success has been most encouraging, saving all the mothers and 43 per cent. of the children. His special method will now be given in his own words:[2] "The practice which I follow consists not in a single method for stopping hemorrhage, but in several; and it is this: In the first place, in every one of my own patients or those I am consulted about, when hemorrhage occurs after the seventh month, when it is clearly not from the cervix or os, and when there is presumptive evidence that it is from the placenta prævia, I advise premature labor to be introduced, or before that period of pregnancy when the hemorrhage is severe, continuous, or frequently recurring. In cases that admit of a little delay from the symptoms not being very urgent, I appoint a time when I can give a few hours' continuous attendance—two hours is generally sufficient—as, once you commence to induce labor, I consider it necessary to remain with the patient until delivery is accomplished; and when the case does not require instant action, one can fix his own time and can have what assistance he requires.

"I find having an assistant a great advantage, and by thus arranging a definite time practitioners can secure the services of a specialist or fellow-practitioner to help them and to share the responsibility. On examination, if the cervix will permit it, I introduce my finger, separate the placenta all around, and then put in a Barnes bag; and if not, I gently and slowly insinuate my finger through the os, which I have always found easy of accomplishment, never having had recourse to the preliminary introduction of a tent, though in inducing labor for other causes I have had frequently to introduce tupelo tents. Having thus dilated the cervix with my finger, I separate the placenta freely around the internal os, and at once introduce a Barnes bag. I slowly fill it with water. And here let me give a practical hint on the use of hydrostatic bags which I do not remember to have seen mentioned in any of the textbooks: When the bag is well through the cervix it is very difficult to say how full it is, and by continuing the injection it may very easily be burst, as once happened to myself, and has, I know, happened to many others; so, to avoid this, it is desirable to ascertain and remember how many syringefuls each bag requires before it is fully dilated, and then to carefully inject only that number. Having thus filled the bag, I wait patiently until the os is well dilated around it, and, before introducing another one, separate the placenta further should the hemorrhage continue, which it does not, provided the placenta has been sufficiently separated at first. After the bag has been introduced for some time the pains come on fairly well, though as a rule they are not very strong.

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[1] *Transactions of the New York Medical Association*, vol. iv.

[2] *Medical Press and Circular*, 1885.

"I thus proceed until the os is fully dilated, when I give ergot freely, and decide what is the most suitable course to follow. If the placenta is lateral or marginal and the pains fairly strong, I rupture the membranes and leave the case to nature; or if the head is well into the pelvis I may apply the forceps; but in the great majority of cases I perform version, preferably by the combined method, and deliver the child as quickly as is consistent with the safety of the mother."

If the practice of Murphy be adopted, the obstetrician must be most careful in carrying out the method to use antiseptics—an antiseptic vaginal injection preceding the dilatation and continued from time to time during it, and the Barnes bags employed must be perfectly clean and dipped in such solution before introduction: after the labor is over the uterus, at least its lower portion, is to be washed out with a hot solution of corrosive sublimate—1 part of the mercurial to 4000 of water.

The treatment of placenta prævia when labor occurs spontaneously, whether at term or previous to this time, can be most conveniently considered by presenting the chief methods that have been employed. These are turning, the tampon, rupture of the membranes and partial detachment of the placenta, and dilatation of the os uteri. Podalic version in the treatment of placenta prævia is not a new practice. The "judicious" Denman nearly a century ago taught it, saying that no "regard is to be paid to the part of the child which may present, for it must always be delivered by the feet;" he also taught that when the hand is carried to the placenta attached over the os uteri, it is of little consequence whether we perforate the placenta with our fingers or separate it on one side till we come to the edge, though the latter is generally preferable. As has been stated, Rigby (1776) maintained that the hemorrhage in case the placenta was situated over the mouth of the womb was unavoidable, and "could not possibly be suppressed by any other method whatever than the timely removal of the contents of the womb;" and to this end he used, if necessary, digital dilatation of the os, and then podalic version with extraction of the fœtus: it really was what is known as *accouchement forcé*. Obstetricians before Portal had demonstrated that the placenta might be attached over the mouth of the womb, and sought to combat the consequent hemorrhage by podalic version.

Braxton Hicks[1] in 1860 presented his method of performing version, and spoke of it as especially applicable to cases of placenta prævia: the reasons for its applicability in the latter condition were that it was possible to turn when the os was only sufficiently dilated to admit the finger, by which the knee or foot of the fœtus could be brought down, and by drawing it through the os perfect command of the hemorrhage, as well as of the labor, could be secured: in a subsequent contribution[2] he urged the importance of not delivering the child rapidly after the performance of version, and stated that when so much of the child has passed through the cervix as its dilatation will allow of, a gentle traction—merely the weight of the arm, he believed—would restrain any further bleeding.

Lomer has recently[3] given the following description of his practice: "Turn by the bimanual method as soon as possible, pull down the leg, tampon with it and with the breech of the child the ruptured vessels of the placenta. Do not extract the child then; let it come itself, or at least only assist its expulsion by gentle and rare tractions. Do not wait in order to perform turning until the cervix and os are sufficiently dilated to allow the hand to pass: turn as soon as you can pass one or two fingers through the cervix. It is unnecessary to force your fingers through the cervix for this. Introduce the whole hand into the vagina, pass one or two fingers through the cervix, rupture the membranes, and turn by Braxton Hicks' bimanual method. Use chloroform freely in performing these manipulations. If the placenta is in your way, try to rupture the membranes at its margin; but if this is not feasible, do not lose time; get hold of a leg as soon as possible, and pull it down." It is plain that there is not an essential part of this treatment, if we except perforation of the placenta in some cases—and that means death to the child—which was not taught by Hicks more than twenty years before. Zweifel refers to "the new treatment" as sustained by a large collection of brilliant results, stating that it was recommended by Braxton Hicks and Kaltenbach, and first practised in a large number of cases by Hofmeier. The last in 37 cases lost only 1, while Behm did not have a single patient die in 40. As has been previously stated, the fœtal mortality if this method be employed is very great; and Zweifel suggests, for the purpose of lessening this, to avoid perforating the placenta: the plan he proposes is to have the woman lying upon her side while the obstetrician introduces two fingers into the uterus anteriorly until they pass above the pubic symphysis, for thus the fingers can be carried farther up in the cavity of the uterus, and hence more probably attain the membranes. He mentions a case of placenta prævia totalis in which he was successful by this method, avoiding perforation of the placenta and saving both mother and child.

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[1] *Lancet*, July, 1860. [2] *Transactions of the London Obstetrical Society* for 1863.

[3] *American Journal of Obstetrics*, 1884.

The tampon treatment is an old one also. Credited by the French to Leroux (1776), it ought to be remembered that his use of the tampon was advised in uterine hemorrhages in general, and not especially for those caused by the placenta being prævia; Wigand was probably the first to systematically employ this means in the condition just mentioned. I have elsewhere[1] given the details of Wigand's method which he employed for many years, and which in suitable cases he claimed always saved the lives of both mother and child. If the pains were active and the position of the child favorable, Wigand, after the introduction of the tampon, left the further progress of labor to nature, the plug being expelled immediately before the child. Many eminent obstetricians, especially among the French, have similarly employed the tampon. The colpeurynter as a tampon in placenta prævia has been advised by some, while others reject it because it cannot be perfectly adapted to the vaginal vault; another objection is that it may be the medium of infection or it may tear. Spiegelberg states that "if the cervix is not canalized and dilatable, so that immediate delivery appears out of the question, plugging must be resorted to—not with india-rubber bags, which exert but little pressure on the lower segment of the uterus," etc. A tampon may be made of absorbent cotton formed in balls about the size of a small walnut; fifty or sixty of these will be required—a hatful, according to Pajot. The bladder and rectum are first emptied and the vagina thoroughly washed out with an antiseptic solution, all clots being carefully removed; the patient may lie upon her side or upon her back: the former position is necessary if a Sims' speculum is used, but this instrument is not essential in order that the vagina may be thoroughly tamponed. The practitioner seizes with forceps one of the cotton balls, and after coating it with an antiseptic ointment, carries it up to the vaginal vault; one after another is thus introduced until the vault is completely packed; the os is covered with the cotton packing, or if possible one or more of the balls passed into it first, and then the rest of the vagina is filled, a large piece of cotton placed between the labia, and the whole secured by a napkin and a T-bandage. It is not advisable to dip the cotton balls in astringent solutions, for then they needlessly irritate or may inflame the vaginal walls; and the essential idea involved in this application of the tampon is arrest of hemorrhage, not by coagulation of the blood, but by direct pressure. If the cotton balls are covered with an ointment they do not become soaked with fluids and lessened in size; moreover, thus prepared the vagina can be more thoroughly packed; a uniform mass completely distending it is formed.[1]

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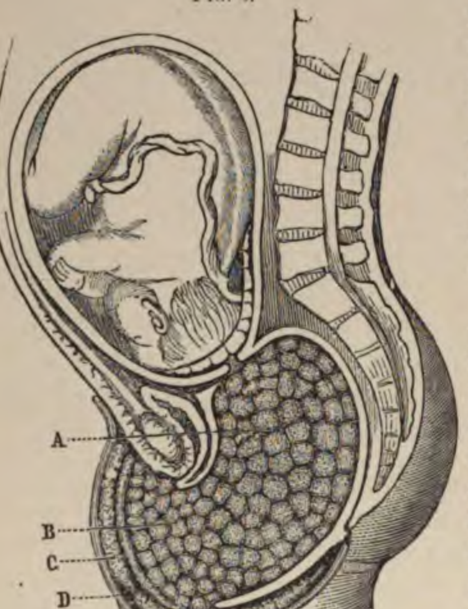
[1] *Science and Art of Obstetrics.*

One of the benefits of the tampon in the majority of cases is that it causes vigorous uterine contractions. The chief objections that have been made to it are that it may convert an open into a concealed hemorrhage, and that septicæmia is liable to follow its employment. In answer to the first objection, it may be confidently asserted that bleeding will not follow a properly-applied and carefully watched tampon. The reply to the second objection is that septic infection is impossible if the vagina be first thoroughly cleansed and then antiseptically closed. Zweifel remarks that tamponing is wholly rejected by some, and at best is only permissible when the vaginal portion still remains and in the absence of pains; yet on the other hand, they recommend the colpeurynter strongly, so that strict disinfection is possible; but he admits that in case cotton that has been sterilized by heat or by impregnation with iodoform is used the chief objection is removed.

The tampon may be left in place for twenty-four hours, if necessary, without injury; Depaul did not remove it for twelve or fifteen hours at least, or for twenty-five or thirty hours at most. After its removal the vagina must be thoroughly cleansed with an antiseptic solution, when a new tampon is introduced if hemorrhage continues or immediate delivery is impracticable; in certain cases, the presentation being normal, some practitioners, following the method of Wigand, among whom may be mentioned Pajot and Bailly, wait the expulsion of the tampon by the same contractions that expel the child. The method just mentioned, however, is rarely employed by practitioners now, the majority regarding the tampon as

FIG. 5.



Vaginal Tampon in Placenta Prævia: A, deeply-placed dossils, to each of which a cord is attached; B, superficial dossils without cord; C, pledget of charpie or pad of cotton; D, T-bandage.

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[1] Strips of iodoform gauze may be very well employed for a tampon.

simply a temporary means. Müller,[1] after remarking that it is neither a sovereign remedy, as its friends claim, nor to be entirely rejected, as its enemies desire, states that it is an important aid which should be used at the right time, and then no longer than is necessary: apply it when the os is rigid and only slightly opened if violent hemorrhage occurs, for immediate delivery is impossible; time is thus gained without danger, for even if it does not stop it lessens the bleeding, and prepares the parts for labor. According to statistics given by Auvard, when the tampon was used the maternal mortality was 6 per cent. and the fœtal 55 per cent.[2]

Rupture of the membranes was first advised by Puzos in the treatment of placenta prævia in 1759, and it is known as his method. But dilatation of the os with the finger preceded rupture of the membranes. If the discharge of the amnial fluid be followed by vigorous uterine contractions, the result as to hemorrhage is favorable; the lessened size of the uterus permits retraction of the os, but if such contractions fail, then the hemorrhage is increased or at least not lessened. According to Auvard, the results of this method are a maternal mortality of 13 per cent. and a fœtal of 46 per cent.

Detachment of the placenta was brought before the profession by Radford in 1819, and by Kinder Wood[3] in 1821, as a conditional or exceptional operation, and by Simpson[4] in 1845. This method, never regarded by its advocates as of common, but only of occasional, application, is to-day almost without any supporters.[5]

Partial detachment of the placenta has been advocated and practised by Barnes, Cohen, and Davis. Barnes' method is founded upon the proposition that the "physiological arrest of flooding is neither permanent nor secure until the whole of that portion of the placenta which had adhered within the lower zone of the uterus is detached, that being the portion which is liable to be separated during the opening of the lower segment of the uterus to the extent necessary to give passage to the child." The following are his directions: "Pass one or two fingers as far as they will go through the os uteri, the hand being passed into the vagina, if necessary; feeling the placenta, insinuate the finger between it and the uterine wall; sweep the finger round in a circle, so as to separate the placenta as far as the finger can reach; if you feel the edge of the placenta where the membranes begin, tear open the membranes freely, especially if they have not been previously ruptured; ascertain, if you can, what is the presentation of the child before withdrawing your hand. Commonly, some amount of retraction of the cervix takes place after the operation, and often the hemorrhage ceases. You have gained time. You have given the patient the precious opportunity of rallying from the shock of a previous loss and of gathering up strength for further proceedings.

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[1] *Placenta Prævia.*

[2] Schatz regards the tamponade of the vagina as better than the colpeurynter (Winckel, *Lehrbuch der Geburtshülfe*).

[3] *London Lancet*, 1847.

[4] Simpson's *Works.*

[5] A qualified approval is given it in some cases by Prof. Alexander R. Simpson. (See his *Contributions to Obstetrics and Gynecology*, p. 84.)

"If, the cervix being now liberated under the pressure of a firm binder, ergot, or stimulants, uterine action returns so as to drive down the head, it is pretty certain there will be no more hemorrhage; you may leave nature to expand the cervix and to complete the delivery; the labor, freed from the placental complication, has become natural."

Dr. Barnes has recently stated that his method gives 33 per cent. of children born alive, and that concurrently with a larger saving of mothers than has been secured by any other methods. Certainly the method in the hands of Murphy, as previously explained, has given better results than any other. Cohen's method—that of Davis is similar to it—consists in the introduction of the index and medius in the os, and causing them to penetrate between the placenta and the uterus in that direction which offers the least resistance, separating the former until the membranes are reached, when they are ruptured, and the fingers hooked over the placental margin draw it toward the vagina, causing it to project from the womb. It has not the physiological basis upon which that of Barnes rests, and cannot supersede it: it probably has only the effect of the treatment advised by Puzos, rupture of the membranes, though possibly the drawing down of the liberated portion of the placenta may slightly facilitate the descent of the presenting part of the fœtus, and thus direct pressure upon the bleeding placental site is secured. Barnes, with other eminent authorities, holds that when the lower uterine segment is converted into a cylinder sufficient in diameter for the transmission of the fœtus, no more placental tissue is detached, and the hemorrhage, if there be efficient uterine action, ceases. Accepting this, the statement as to treatment advised by Spiegelberg is to be rejected. He, after stating that the arrest of the hemorrhage at the area of placental attachment brought about by contraction or diminution of the latter, by the consequent narrowing of their wounded vessels, and to a less extent by thromboses of their lumina, adds: "A satisfactory degree of contraction, however, is only possible when the uterus is completely emptied; and the end, therefore, which must, above all things, be kept in view, is to effect this as quickly as possible." This was the teaching of Rigby, and it fails in the recognition of the fact that the hemorrhage usually ceases under the circumstances previously mentioned, and it is doubtful whether it gives proper regard to the interests of the child. The obstetrician may be called when the patient is so exhausted by flooding that life is almost extinct, and she may die while he is endeavoring to deliver or immediately after delivery. Rigby refers to the unjust reproach he may suffer from the public if there should be such unfortunate event. But he adds the following golden words, which are worthy to be treasured up by every obstetrician: "These may be tolerable arguments in trade, but they are unjustifiable ones in morals, which direct us always to do what is in itself right, independent of the opinions of the world and the consequence that may follow it."

Nevertheless, in such cases immediate interference will depend upon whether the hemorrhage continues or has been arrested. If the latter be the case, the attendant should first address his efforts to relieving the prostration. Stimulants may be given by the mouth if the stomach will tolerate them; hypodermics of sulphuric ether, the introduction of fluids into the rectum and into the stomach, so as to compensate for the loss of blood as soon as possible, are indicated. In reference to the value of fluids thus employed, the following passage from Zweifel is of interest: "Recently several very interesting contributions have been made, showing very clearly that which is especially accomplished by transfusion, the refilling of the blood-vessels with fluid. Even after the greatest loss of blood, enough blood is left in the circulation to supply the centres of respiration and enable them to perform their function. But the remaining blood and its oxygen no longer reach these centres, for the movement of the blood stops. If the heart, because of the hemorrhage, is supplied with less blood continuously, it pumps out its contents and becomes empty and paralyzed. Even though the animals experimented upon were brought into a state of extreme anæmia, and had reached the point of asphyxia, an alkaline solution of salt, 0.5 per cent., restored them so completely that they were able to walk after they were untied. The practical significance of these experiments is very great, for it shows the suitable treatment, which consists in bringing the greatest amount of fluid possible into the circulation; and this should be done through the natural channels —by the mouth or by the rectum, or by both at the same time."

After reaction has been secured the obstetrician proceeds with the requisite special treatment. The placenta may be discharged immediately after the child, but in some cases it is still adherent at some parts, and then these adhesions must be broken and the organ removed by hand. A hot solution of corrosive sublimate, 1 : 4000, should be injected into the lower part of the uterus as a safeguard against hemorrhage and infection. If hemorrhage occurs and does not yield to the hot water, there may be pressed upon the bleeding surface a sponge previously dipped in vinegar, or a solution of iodine or of one of the salts of iron may be brushed over it. According to Spiegelberg, the cervix and the vaginal fundus may, if necessary, be firmly plugged, while pressure from above, made first with the hand, afterward with a pad and binder, meanwhile prevents the uterus from ascending and compels it to remain contracted and to keep in the place it had assumed.

The great importance of careful observance, not merely of cleanliness in all the manipulations and instruments employed in the treatment of placenta prævia, but of careful and thorough antisepticism, cannot be too strongly enjoined. It is but a trifling victory to save a poor woman from the peril of hemorrhage, and then permit her to perish by possibly a preventible septic infection. Let the obstetrician never forget that the liability to septic infection is greatly increased by placenta prævia, and be prepared to use all means to avert this imminent danger.

Accidental Hemorrhage.—The so-called accidental hemorrhage, or that which occurs from premature detachment of the normally-situated placenta, is not frequent, and especially its grave form is rare. The hemorrhage may be open or concealed, or both forms may be present. The detachment of the placenta, usually partial, causing it, may be the consequence of general disease, such as variola, scarlatina, typhoid fever, or of local disease, nephritis or acute yellow atrophy of the liver. Excessive distension of the uterus has been observed in some cases, while in others it has been the consequence of violent straining at stool, lifting a heavy weight, or severe coughing. Probably, however, the most frequent cause has been some local injury, as from a blow or a fall. In illustration of this origin the following cases are given, the first occurring during one of my terms of service at the Philadelphia Hospital, and reported by my then resident, Dr. J. C. DaCosta, and the second reported by Kormann: "J. L——, thirty years of age, multigravida, when at the end of the seventh month of pregnancy slipped and fell, the right iliac region striking a boiler. She immediately had severe pain, and blood flowed from the uterus to the amount of nearly a quart in a few minutes; then stopped. The finger readily entered the uterus. The pulse was very rapid and weak, the expression anxious; body agitated with tremors and covered with cold sweat; pupils dilated; heart's action weak, irregular, and beats intermittent; respiration shallow and hurried. Immediately upon being placed in bed she was given whiskey and aromatic spirits of ammonia; the head of the bed was lowered by raising the foot, the vagina was washed out with a hot solution of corrosive sublimate, and opium given freely. The hemorrhage did not return, and the pain gradually subsided in two days. The pregnancy went to term, when she was delivered of a healthy, well-developed child."

Kormann's case is as follows: "A multipara, desiring to finish some household duties, fell down a steep flight of steps into the cellar, and when carried to bed showed symptoms of grave uterine hemorrhage.

Upon my arrival I found her dying: the os uteri was dilated to the size of a dollar, and was soft; the uterus was greatly distended, and the child was dead. Cæsarean section done immediately after her death confirmed the fact of the child's being dead, and showed that the placenta had been almost completely detached, and that the blood from the uterine surface had passed through a rent in the membranes into the fœtal sac, hence enormous dilatation of the uterus, and also a fatal hemorrhage without discharge of the amnial fluid."

More frequently in case of concealed hemorrhage the blood, instead of entering the fœtal sac as in the case of Kormann, collects between the external surface of the ovum and the internal surface of the uterus, either between the placenta or the membranes and the uterus.

The SYMPTOMS of concealed hemorrhage are an acute anæmia, shock, severe pain, and excessive distension of the uterus; in some instances the seat of this severe uterine pain is marked by an unusual prominence caused by the accumulated blood.

The PROGNOSIS in concealed is much more grave than it is in open hemorrhage, for usually in the latter the flow is not great or there is a sudden gush and then the hemorrhage ceases, as in the case first reported. Goodell, in referring to the diagnosis of concealed hemorrhage, states[1] that "very often before the lapse of many hours a show of blood, ranging from an ooze to a gush, will clear up all obscurity; but this trustworthy symptom does not usually occur at the outset of the attack, but at a time when it may be too late to interfere." It is obvious, therefore, that in cases of both internal and external hemorrhage the prognosis is as serious as in those in which only the former occurs. Goodell's collection of 106 cases of internal hemorrhage gave a maternal mortality of 51 per cent., while the fœtal mortality was 94 per cent.

TREATMENT.—If the hemorrhage be external and continuous, in addition to the use of stimulants and other means to bring about reaction the vaginal tampon is indicated, provided the accident does not happen in labor, the os being so well dilated and the uterine action so vigorous that delivery can be soon accomplished, and under the latter circumstances rupture of the membranes is indicated, followed by careful compression of the uterus and the administration of ergot.

In case of concealed hemorrhage the practice generally advised is rupture of the membranes, followed by uterine compression. Spiegelberg, however, takes the ground that as long as the effused blood continues in the uterine cavity and stretches its parietes, this stretching and the raised intra-uterine pressure prevent any more blood being poured out, while, conversely, if the uterus is emptied, fresh bleeding may at once begin. But, as is known—the case of Kormann, for example, illustrating the fact—distension of the uterus is an uncertain reliance for the arrest of hemorrhage; nay, this organ may so yield to the pressure of the effused blood that a woman may perish in a few minutes without a drop of blood having escaped externally. Uterine contraction furnishes a more reliable hæmostatic than is found by pressure in uterine expansion, and this contraction is only possible after evacuation of the liquor amnii.

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[1] *Am. Journ. Obstet.*, vol. ii.

If the os uteri be sufficiently dilated to admit of immediate delivery either with forceps or by podalic version, the one or the other is to be employed; if it be undilated, digital dilatation or Barnes' dilators will be employed. It is not necessary to urge the importance of position, of stimulants, and of hypodermic ether for the purpose of combating the prostration and averting the danger of instant or of speedy death.

Hemorrhage in the Third Stage of Labor, or Following it.—The hemorrhages following childbirth, as was stated previously, have different causes, and of course require different treatment. Vaginal and vulvar injuries as sources of these bleedings have been considered, and methods of treating them directed. The field is still more restricted, for there have already been presented inversion and rupture of the uterus and lacerations of the cervix, with the treatment necessary, including that of the bleeding that may originate in any one of these accidents. There remains, therefore, only that bleeding which occurs from the placental site after the expulsion of the fœtus.

The separation of the placenta from the uterus wounds the latter, the blood-vessels where the former was attached are torn, and the prevention of bleeding from these open vessels is made in part by the formation of coagula, but chiefly by retraction or tonic contraction of the uterus; thereby "thousands of living ligatures" are drawn around these vessels and their open mouths closed. From the fact that this bleeding results from a failure of tonic contraction of the uterus it is commonly called "atonic hemorrhage."

This is the variety of serious post-partum hemorrhage which is most frequently met with, and yet its most common causes are preventible, and its frequent occurrence in the hands of a practitioner may be taken as a proof of ignorance or of negligence. Weak uterine contractions in the first and second stages of labor may be the heralds of inefficient uterine action in the third stage or after its completion. If the uterus be rapidly emptied by the forceps or spontaneously, and care is not taken to "follow down" with the hand upon the abdomen the lessening organ as its contents are removed; if there be no watchful care of the patient during and after the expulsion of the placenta; if the woman be allowed to sit up soon after labor, though but for a few minutes, to evacuate the bladder, for example,—the flooding may occur. Not only rapid delivery, but frequently-recurring pregnancies;

very great uterine distension, as from pluriparity or from polyhydramnios; changed condition of the blood, as in albuminuria; exhaustion from disease or from protracted labor,—are causes that create a liability to post-partum hemorrhage. Clot or placenta obstructing the os uteri may permit accumulation of blood in the uterine cavity, thus distending it until all the barriers to abundant bleeding from the placental site are removed. The flow, instead of being internal, may be external, and the red stream dripping through or flowing from the side of the bed tells the startling story of instant peril.

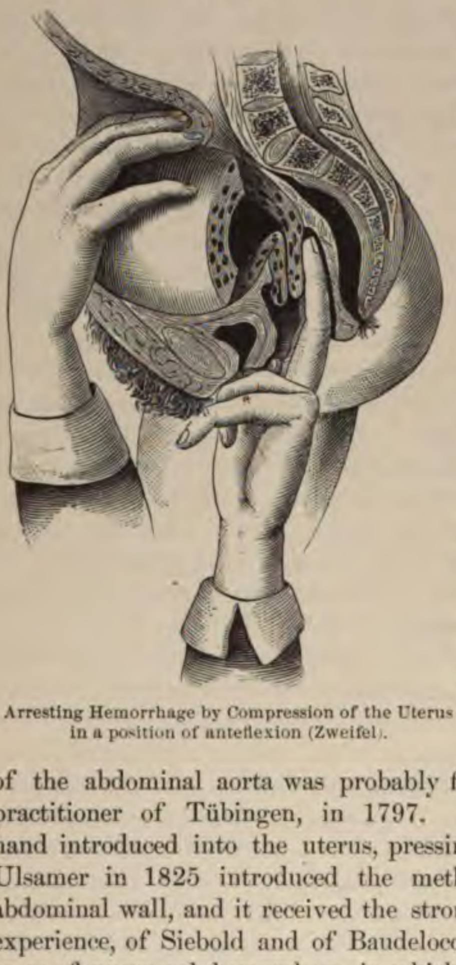
The SYMPTOMS of post-partum hemorrhage are, in addition to that which has been mentioned as possibly occurring when the bleeding is external, very striking, and cannot escape the observation of even the inexperienced practitioner. The thirst, the death-like pallor of the face, the sighing and gasping, the restless tossing of the arms as if blindly seeking help, the dilated pupils, and the dim or lost vision of which, with "ringing in the ears," the patient may complain,—all these make a picture, sometimes sudden in its recognition if not in its apparition, which will at once declare the imminent peril and its cause, and must remain for ever fixed in the memory.

TREATMENT.—If ever there is a time more than any other in the obstetrician's life when he needs to be calm and collected and to put forth prompt and intelligent action, it is when he is brought face to face with post-partum hemorrhage. If he participates in the anxiety and alarm of bystanders, he will hesitate and falter in the instant use of necessary means, and fear becomes panic, while the peril of the unfortunate patient is increased by every minute's delay and by her loss of faith in him; but if, on the other hand, he is armed with that self-confidence which comes from knowledge, he inspires others with confidence, and they render prompt and wise obedience to his directions, and he, doing the right thing at the right time and in the right way, will generally have the unspeakable reward of saving a fellow-being from swift death.

In addition to lowering the patient's head and the administration of stimulants and of hypodermic injections of sulphuric ether, etc., applicable in other cases of bleeding with consequent exhaustion, we use direct means to arrest the bleeding. First of these is uterine compression. The usual method of doing this is to grasp the uterus through the abdomen with one hand, while the other is introduced into the uterine cavity in order that its presence may evoke uterine contraction. Possibly, too, the placenta may still be in the uterus, either free or partially attached; in the latter case the fingers are used, as the uterus lessens in size, to detach it, and in either case to remove it from the uterus at the proper time. Probably the uterus is very sensitive when pressed by the abdominal hand, but this arises from its great distension, and as soon as the organ is emptied the excessive sensibility ceases; possibly the uterus cannot be felt at first by this hand—it is so relaxed that it has lost its form—but then so much the more need of prompt action.

Should this means fail in arresting the hemorrhage, compression of the uterus, placed in a position of anteflexion, may be employed: Zweifel says it ought to be possible to stop every atonic hemorrhage by energetic use of this treatment. In the performance of this method pass two fingers into the posterior cul-de-sac, and press the cervix forward, while the other hand, upon the abdomen, is made to press upon the fundus posteriorly, bringing it also forward, as shown in the accompanying illustration.

FIG. 6.



Arresting Hemorrhage by Compression of the Uterus in a position of anteflexion (Zweifel).

Compression of the abdominal aorta may be made with the fingers of the left hand, the obstetrician being upon the patient's right side: the abdominal wall is depressed just above the uterus and a little to the left of the median line until the pulsations of the vessel are felt, and then slight pressure with the first three fingers will arrest the current. An assistant will be needed, for the fingers become too tired after twenty or thirty minutes to maintain efficient compression. Compression of the abdominal aorta was probably first advocated by Rüdiger, a practitioner of Tübingen, in 1797. His method was with the hand introduced into the uterus, pressing through its posterior wall. Ulsamer in 1825 introduced the method of pressure through the abdominal wall, and it received the strong indorsement, from personal experience, of Siebold and of Baudelocque. Gros[1] has reported nine cases of puerperal hemorrhage in which it was successfully employed. Zweifel holds—this objection has been made by Jacquemier and others—that it is impossible to cut off by this means all the blood-supply to the uterus, because the spermatic arteries pass off from the aorta above the part compressed, and that the chief benefit is in preventing cerebral anæmia, in this respect being upon the same level as bandaging the limbs or what is known as auto-transfusion.

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[1] *De la Compression de l'Aorte dans les Hémorrhages pour apres l'Accouchement.*

Uterine contractility has been in some cases evoked by flapping the abdominal wall with a wet towel, by pouring cold water from a height upon the exposed abdomen, by the application of ice to it, by the introduction of pieces of ice into the vagina or into the uterus, or by the injection of cold water into each. In recent years, however, the general preference has been for injection into the uterus of hot, rather than of cold, water, the former being more efficient than the latter in producing permanent contraction and stimulating rather than depressing. The water should have a temperature of not less than 105° Fahr., and the injection be made by an irrigator rather than by a pump. The application of vinegar to the interior of the uterus was probably first advised by Leroux[1] in 1776. Since then many obstetricians have regarded this remedy as of very great value. Dr. Penrose,[2] for example, states that he has been using it alone as his last resort, both in hospital and private practice, in many apparently desperate cases of post-partum hemorrhage, and invariably with successful results. His method is the following: "I pour a few tablespoonfuls into a vessel; dip into it some clean rag or a clean pocket-handkerchief. I then carry the saturated rag with my hand into the uterus, and squeeze it; the effect of the vinegar flowing over the sides of the cavity of the uterus is magical. The relaxed and flabby uterine muscle instantly responds." Similar stimulating applications have been successfully made to the interior of the uterus —*e. g.* whiskey. Betz[3] succeeded in arresting post-partum bleeding by introducing into the uterus a sponge upon which chloroform had been poured; and it has been claimed that this agent acts by a powerful excitement of the walls of the vessels either directly or through the vaso-motors, and that it is incomparably more energetic than vinegar similarly applied.

The employment of a styptic solution of one of the iron salts has been resorted to with success. There are three ways in which such a solution is used—by injection, by swabbing, and by tamponing. Dr. Robert Barnes has been the especial advocate of the first. The following quotation[4] gives the formula for the iron styptic employed by him and his method of using it: "Solid ferric chloride ℥j, dissolved in ℥x of water, or the liquor ferri perchloridid. (Br. Ph.) ℥jss, water ʒvijss. The rules in using it are: (1) be sure that the uterus is empty of placenta, blood, and clots; (2) compress the body of the uterus by the hand during the injection; (3) have two basins at hand, one containing hot water, the other the ferric solution; pump water well through the syringe—a good Higginson's will do—so as to expel air; then pass the uterine tube into the uterus, and inject first hot water, so as to wash out the cavity and give a last opportunity for evoking diastaltic contraction; then shift the receiving end of the syringe into the ferric solution, and slowly, gently inject about seven or eight ounces, carefully keeping up steady pressure on the uterus throughout and afterward."

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[1] *Observations sur les Pertes du Sang des Femmes en Couches.*

[2] *Transactions of the American Gynecological Society*, vol. iii.

[3] *Revue Medico-chirurgical des Maladies des Femmes*, 1886.

[4] *Obstetric Medicine and Surgery*, vol. ii. p. 292.

Dr. Wynn Williams[1] has advised applying the iron solution by means of a sponge to the interior of the uterus. He directs pouring some of the tincture of the perchloride of iron into a sponge, which is then passed into the hollow of the hand already in the uterus, clots from the latter having been removed, and then the walls of the uterus are thoroughly sponged over.

Tamponing the uterine cavity with cotton that has been dipped in a solution of the chloride of iron is regarded by Zweifel as only a final resort when all other appropriate means have been vainly tried; and he refers to one case, the only one in which he tried this heroic treatment, which recovered with very slight elevation of temperature. He directs two or three tampons to be dipped in a solution of chloride of iron, and then pressed directly upon the placental site, while external pressure is simultaneously made upon the uterus; if the bleeding still continues, the application is repeated until it stops. He prefers this treatment to injections of an iron solution, stating that he has seen one patient die after such injection, and another recover after the tampon.

There are delays, difficulties, and dangers in transfusion which render it unavailable in the great majority of cases of acute puerperal hemorrhage, at least in general practice, though some of these obstacles are not found in hospital practice. Very few practitioners have the suitable apparatus; and if they have it, from rare use it is usually not in working order. Nor is the necessity for transfusion so great when we know how prompt hypodermics of sulphuric ether are in rallying a patient from the collapse caused by hemorrhage, and how efficient the introduction of fluids through the natural channels, as previously stated, is in reviving a flagging, faltering heart.

Auto-infusion has upon theoretical grounds and from small experience somewhat to recommend it. By bandaging the members so that the blood which they contain is pressed out, and thus contributes to sustaining vital functions, possibly at times imminent death may be averted. But, on the other hand, death may be thus invited, for fatal pulmonary embolism has followed the employment of this means.

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[1] *London Obstetrical Society's Transactions*, 1870, vol. xi.

Secondary Hemorrhage.—The subject of hemorrhage in connection with labor cannot be dismissed without briefly referring to a form of this disorder occurring one or more days after delivery during the puerperal period, and which is commonly called secondary. The most frequent cause is the retention of fragments of placenta or of membranes; a placenta succenturiata has in some cases given rise to dangerous hemorrhage. Several cases have been reported in which the retention of a blood-clot has caused flooding. Ordinarily, the uterus is adequate to the expulsion of clots that may form in its cavity, but sometimes, this expulsion failing, the clot increases in size; the lochial discharge is scanty and serous; the uterus, though notably increased in size, is firm and resistant; for a time the clot acts as a tampon pressing upon the placental site, and thus prevents hemorrhage. After some days the coagulum spontaneously breaks up, the protecting pressure is at once withdrawn from the open vessels at the placental site, and a hemorrhage which is perilous or may be instantly fatal at once follows. In some instances a uterine fibroid or polypus has been the cause of secondary puerperal hemorrhage. Mental emotion has in several instances produced it. Lactation, sexual intercourse, too early assumption of the erect position or engaging in household duties, the influence of malarial poisoning, and certain displacements of the uterus have been mentioned as causes. Among very rare cases may be stated one reported by Hewitt[1] of fatal hemorrhage the sixth week after labor from traumatic aneurism of the uterine artery, and one by Johnson[2] and Sinclair in which death occurred the fourth day following delivery from rupture of a uterine thrombus.

In regard to the special treatment of secondary hemorrhage, the importance of removing any foreign body, as a fragment of the placenta or clot, from the uterus is to be borne in mind. In regard to the method of emptying the uterus of a mass of coagulated blood which distends the organ, the fingers, Pajot's curette, or a stream of carbolized water may be employed. During this removal compression of the uterus externally is important in order to secure retraction of the organ and thus prevent hemorrhage. The cases are rare in which the uterus is not able to empty itself, but certainly some occur in which direct means must be used for the purpose, and thereby possibly a fatal hemorrhage may be prevented; thus Contamin[3] found in 6 out of 56 cases of secondary hemorrhage an intra-uterine coagulum the cause.

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[1] *London Obstetrical Society's Transactions*, vol. ix.

[2] *Practical Midwifery.*

[3] *Étude sur les Hémorrhagies.*

ECLAMPSIA.

Eclampsia, adopting Bailly's definition, is an acute disease occurring during pregnancy, labor, or childbed, often sudden in its onset and rapid in its progress, characterized by convulsions, with loss of sensation and consciousness, and ending in coma. The sudden attack is indicated by the word "eclampsia," from *εκλαμπω*, to shine out, to flash.

The disease is most frequent during, least frequent after, labor. Nevertheless, the relative frequency of eclampsia in pregnancy and in labor is not conclusively determined, for, the latter so often coming on as a consequence of the convulsive attacks, many of the cases which really belong to gestation may be recorded as occurring during parturition.

FREQUENCY.—In regard to the proportion of women affected to the entire number of deliveries statistics vary: Hecker, 1 in 522; Wieger, 1 in 519; Kleinwächter and Galabin state 1 in 500, and Kormann 1 in 600; Corson[1] met with 10 in 3036 cases of labor, or about 1 in 300. According to the statistics of the Philadelphia Board of Health, there were in the five years from 1880 to 1884, inclusive, 100,935 deliveries, and 94 cases of death from eclampsia: supposing that this mortality represented only one-third of eclamptics, the entire number of those affected was nearly 300, or about 1 in 333. The statistics[2] of the Vienna General Hospital, 1881–85, include 15,070 deliveries, and the entire number of cases of eclampsia was 46, or 1 in about 305.

It is much more frequent in primiparæ than in multiparæ: 28 out of 33 were primiparæ (Hecker); Löhlein in 103 cases of eclampsia found 88 who were pregnant for the first time, or 85.4 per cent.; and Winckel, in 683 eclamptics there were 426 primiparæ, or 77 per cent.

Eclampsia is much more frequent in the last than in the early months of pregnancy, though it has occurred in the first. Coming on after labor, the interval is usually only a few hours, but it may be several days. Bailly, for example, saw a case twenty-nine days, and Simpson one four weeks, and Baudelocque one six weeks, after delivery.[3]

PREMONITORY SYMPTOMS.—Eclampsia rarely comes unheralded, and the most frequent of its forerunners are headache, disturbance of vision, and epigastric pain. The headache is usually frontal, in some instances lateral instead of general; very rarely it is occipital. Hamilton referred to this frontal pain as especially characteristic. It is at first not continuous, or at least it remits if it does not intermit; when it is constant the convulsive attack is at hand. Associated with the pain in the head, if this precedes the attack some days, there may be some mental disorder, usually simply dulness of intellect or a generally apathetic condition. Disturbance of vision is observed in very many cases. This at first is usually indistinctness of sight or inability to use the eyes for any length of time. But there may be amblyopia, or even amaurosis. In one case of fatal eclampsia occurring at four months of pregnancy which I saw there was almost total blindness for two days before the seizure. Epigastric pain is less frequent than either of the other symptoms that have been given. It is not constant, but while it occurs it may be of such severity that the patient cries out or groans with the distress, and leans her body forward to relax the abdominal muscles. Dyspepsia, nausea, and vomiting may precede the attack. Other premonitory symptoms that have been observed are dizziness, mental depression, stertorous breathing at night, œdema of the face and hands, especially noticeable upon first rising in the morning, and a decided diminution in the urinary secretion.

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[1] *New York Medical Journal*, May, 1886.

[2] *Wien. med. Woch.*, 1886, p. 1209.

[3] Kormann, while stating that eclampsia in childbed usually occurs within the first two days, adds that it has been observed as late as eight weeks after delivery.

THE ATTACK.—After a longer or shorter duration of at least some of the premonitory indications which have been mentioned as occurring in most cases, the convulsive manifestations occur suddenly. While these manifestations strikingly resemble an epileptic seizure, they are not preceded by a cry. The patient, lying in bed, may have been conversing, but suddenly she ceases to speak or to listen; her face is immobile as that of a statue, and her eyes are apparently fixed upon some distant object: this is the complete and brief calm preceding the terrible storm. That storm begins with quick movements of the muscles of the eyelids, then of the nasal alæ, and then of all the muscles of the face. The muscles of the upper limbs are next involved, and afterward those of the trunk. Irregular movements of the eyes occur, and then the balls are half hidden behind the upper lids; the face is turned slowly toward one shoulder, and then a reverse movement is made toward the other; the mouth is distorted, and with the swollen and livid face—every mark of intelligence or beauty for the time blotted out—makes a picture that is most painful to the observer, even if not actually repulsive. The tongue may protrude between the half-open jaws, and more or less bleeding occur from its being bitten. Tonic convulsions are first in order, and then clonic, but the boundary-line is not always clear. During the former the body is rigid, and may be arched as in opisthotonos; the upper and lower limbs are stiff, and usually extended, but the thumb is flexed upon the palm and the fingers contracted over it. Co-ordination of respiratory movements is impossible, and from the arrest of respiration, together with compression of the jugular veins, the face becomes more or less deeply cyanosed: the cyanosis would be general if it depended upon the former cause alone. "Soon tonic convulsions are followed by clonic movements, and to the general rigidity of the preceding period there succeed abrupt movements involving the head, the trunk, and members." Respiration, hitherto suspended, returns, but it is at first stertorous; in some instances the inspirations are shallow, but in others deep; at each expiration frothy saliva and accumulations of bronchial secretions, often flecked with blood from the bitten tongue, are discharged, and fall in spray upon the clothing which covers the patient's chest. The pulse is full and strong at the beginning of an attack, but with its progress becomes frequent and feeble. Whether the muscles of organic life are affected by convulsive movements is not conclusively determined. If they are, it is easy to explain the occurrence of labor and the pains being made more active by the convulsions. Braxton Hicks[1] states that in one case of eclampsia occurring in the sixth month of pregnancy, when an attack of convulsions came on the uterus became intensely firm, and so remained for the space of ten or fifteen minutes without any change, after which it slowly subsided into the ordinary condition of gentle contraction with relaxation. Similar phenomena were observed by him in a second case. Nevertheless, most do not regard uterine action as part of the convulsive attack. During the paroxysm the patient is insensible to the most powerful external excitants: she can neither see nor hear nor feel. Coma or stupor follows the cessation of the clonic movements, its duration being directly proportioned to the severity of the attack. In most cases within half an hour after calm has succeeded convulsion the patient wakes to a kind of semi-consciousness; she looks upon those surrounding her bed, but does not at once recognize them, and when the tardy recognition comes she does not understand the anxiety which their countenances so often express; her face has a sadly bewildered expression; the immediate past is a perpetual blank, and the present a temporary cloud.

In rare cases, possibly, immediate recovery begins, and is complete. But usually eclampsia is not limited to a single attack; other attacks succeed it, the intervals varying from a few minutes to several hours; the attacks may be so rapid, the intervals so brief, that the patient passes directly from coma to convulsion without a moment of even partial consciousness intervening. The coma deepens with each convulsion. Its cause is cerebral congestion resulting from arrested respiration, and impeded return of blood from the head arising from compression of the jugular veins: the congestion may have as its consequence serous effusion, or, though this is rare, an apoplectic effusion. The number of convulsions observed in 135 cases varied from 1 to 81 (Spiegelberg); in one instance Depaul saw 160. The urine is in most cases scanty; in some it is smoke-colored or red from the presence of blood. The duration of the paroxysm varies from two to seven minutes, according to Depaul; Zweifel remarks that we are often deceived as to the length of an attack because of the frightful impression made, and because our attention is absorbed in the battle between life and death, and that occasionally, watch in hand, he has observed some of the longest attacks, and found none exceeding two minutes.

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[1] *London Obstetrical Society's Transactions*, vol. xxv.

Another source of error, as pointed out by Depaul, is the fact that in some cases the convulsions are so close together that their boundary-line is not distinguished. An increase in the temperature is a constant characteristic of eclamptic convulsions; this is an important fact with reference to diagnosis and prognosis. Bourneville,[1] as the result of six years' study of the temperature-changes in eclampsia, has arrived at the following conclusions: There is a very striking contrast between the thermometric curve of temperature of puerperal eclampsia and that of uræmia. At first there is a fall in the latter and a rise in the former. In the curve of uræmia the temperature[2] falls progressively, while in the course of the eclamptic condition it rises abruptly and rapidly with the occurrence of attacks. These differences are more and more striking at the approach of death: in uræmia the temperature falls much below the normal, while in eclampsia, on the other hand, it reaches a very high figure—109.4° Fahr.

TERMINATION.—MATERNAL AND FŒTAL MORTALITY.—PROGNOSIS.—The great majority of cases of eclampsia recover; nevertheless, in a considerable proportion a fatal result occurs. Death may occur during an attack from sudden asphyxia "if the stage of tonic convulsions and the suspension of respiration are prolonged beyond half a minute." However, such occurrence is rare. Cerebral hemorrhage, though less infrequent, is also the cause of death. Rupture of the uterus was regarded by Cazeaux as one of the modes in which death might occur; but this rests upon the unproved hypothesis that the uterine muscle participates in the disordered movements of the muscular system of animal life. Death may result from cerebral congestion, from apoplexy, or from meningitis, and also from pulmonary congestion or apoplexy. The most frequent cause of death is a gradual asphyxia, coma becoming more profound and hæmatosis more and more imperfect. Bailly mentions an instance in which the tongue was so severely bitten that ligature of the lingual artery was necessary for the arrest of the hemorrhage, and, neglecting this, a fatal result might have followed. He also refers to an instance in which the tongue was bitten, and such great swelling followed that the organ filled the buccal cavity and the pharynx, causing a rapidly mortal suffocation. According to Depaul, about one-fourth of women attacked with eclampsia who die perish from a consecutive puerperal affection.

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[1] *Archives de Tocologie*, tome ii.

[2] Wood, in his recent work upon *Nervous Diseases*, after referring to the investigations of Bourneville, remarks: "I am, however, doubtful whether the temperature *always* falls in true uræmia. I have certainly seen it rise in coma occurring in persons suffering from contracted kidney and apparently uræmic."

The maternal mortality is given by Hecker[1] as 27 per cent.; by Dohrn, 29 per cent.; by Hugenberger, 35.1 per cent.; Löhlein, 37.7; Depaul, 50 deaths out of 132 cases. Probably the maternal mortality is in general about 30 per cent. In the majority of those who do not die recovery is complete, but in others some disorder of intellect or of sense may remain for a greater or less time; in some cases there may follow serious renal disease or puerperal mania or paralysis.

The fœtal mortality is about 50 per cent. The death of the fœtus is to be attributed to asphyxia, the placental circulation being interfered with and the maternal blood being deficient in oxygen; possibly, the poisoned condition of that blood may be destructive to the life of the fœtus: another cause is in the high temperature of the maternal blood.

The PROGNOSIS as to the mother—and her salvation is often that of the child—will depend upon the frequency and the severity of the attacks; upon the degree of the disturbance of the renal function; upon whether the temperature still continues to increase, or, on the other hand, is declining to normal; upon the coma being slight or deep and prolonged; upon the readiness with which the uterus can be emptied without violence; and upon whether the patient is suffering from cardiac or pulmonary disease. The prognosis will depend upon when the convulsions occur: if before labor, it is much graver than if during labor, while attacks beginning after delivery are not usually fatal. Thus, Depaul states that of 16 women attacked after labor only 2 died. Galabin says that in the Guy's Charity the mortality was 50 per cent. in cases which began before the onset of labor, 25 per cent. in those which began during labor, and only 8 per cent. in those which began after delivery, the total mortality being 25 per cent.

Charpentier gives the following statistics in illustration of the fact that the prognosis is affected by the number of attacks: The mortality in 45 women, having from one to ten attacks, was 11, or 25 per cent.; in 31, having from ten to twenty attacks, was 10, or 33 per cent.; in 24, having from twenty-one to fifty attacks, was 12, or 50 per cent.

ETIOLOGY.—Lever[2] in 1842 pointed out the close connection between albuminuria and eclampsia; he went so far as to assert that the former always induced the latter, and, conversely, the latter never existed without the former. Admitting the toxæmic origin of the disease, the question as to what was the toxic substance naturally arose. The first answer asserted that it was urea, so that the term uræmic applied to the convulsions seemed eminently proper. This theory, however, was soon cast down, for observation showed that uræmic accidents failed when the blood was charged with urea, and on the other hand occurred when the blood contained but a small quantity: still more, the injection of urea into the blood of an animal did not produce any of the so-called uræmic symptoms. The meaning now attached to "uræmic"[1] points to alteration in the blood caused by the retention in it of products of disassimilation normally eliminated by the kidneys. Frerichs suggested that instead of urea itself being the offending body, it underwent decomposition, and the resulting carbonate of ammonia was the peccant matter; hence the convulsions were ammoniæmic. Chemists have disputed the possibility of this transformation in the blood; it has been proved too that carbonate of ammonia is normally present, and that its injection into the blood of animals is not followed by eclamptic phenomena. According to a third theory, it is not one element, but the various extractive matters, creatin, creatinin, etc., which with urea are retained in the blood; hence the term "urinæmic" has been applied to the convulsions. Peter says the pregnant woman attacked with eclampsia is urinæmic. It is because there is an accumulation of all the elements of the urine in the blood that she suffers with the final accidents known under the name of eclampsia.

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[1] These statistics, except those of Depaul, are quoted from Hecker's report.

[2] Barnes' *Lumleian Lectures*, 1873.

But, without further discussion of this point, it may be admitted that in consequence of renal failure a toxic element is circulating in the blood, and by this poisoned blood the brain and nerve-centres are brought into an irritable condition, which, reaching a certain degree, an explosion in the form of convulsions occurs.

The next object sought was an explanation of why renal disease occurred in pregnancy. The first answer was that the gravid uterus pressed upon the inferior vena cava, upon the iliac veins, and upon the kidneys, and as a consequence there was passive congestion of these organs. Although this view has recently been supplanted by that of Halbertsma, which attributes the renal disease to pressure of the gravid uterus upon the ureters, and which will be presented in a moment, yet it has been sustained in an able article by King: his views are presented below.[2]

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[1] Labadie-Lagrave.

[2] Dr. King holds that premature descent of the fœtal head in the pelvis causes pressure upon blood-vessels and eclampsia—that the head of the child until the near approach of labor normally rests upon one of the iliac fossæ; and he states that the

Halbertsma's[1] hypothesis is, however, that which now rallies the greater number of supporters. The pressure of the gravid uterus is upon the ureters; these are drawn upward by the enlarging uterus, their area being thus increased, and they are not only stretched, but variously flexed and compressed, and thus their permeability is in a variable degree lost. The consequent urinary stasis causes alteration in the renal tissue, unless the stasis be brief: the urine does not contain albumen if the obstruction of one of the ureters is not complete from the onset. If other abdominal tumors rarely cause renal lesions, it is because they are not developed, as the uterine tumor is, between the ureters. He states that even slight pressure upon a ureter will arrest the flow of urine; the experiments of Ludwig upon dogs have demonstrated that the secretory tension of the kidney is very feeble. As is well known, a scanty secretion of urine is one of the most constant forerunners of eclampsia. Leyden has shown from a study of the kidneys of women who died from eclampsia that the changes in these organs are not characteristic of venous stasis, but a simple fatty degeneration of the epithelium. If convulsions are so frequent in the puerperal form of Bright's disease, it is particularly under the influence of the excessive tension to which the urine accumulated in the pelves is subjected: this tension, too, is exaggerated when the uterus contracts, for there is then a renal hyperæmia compensating for the uterine anæmia, but this temporary hyperæmic condition of the kidneys increases the secretion, and thus the injurious effect of the stasis.

Zweifel, after referring to the investigations of Halbertsma, contin-

"leading obstetric authorities of the present day tell us it is proper, customary, and normal for the head of the child to present, and even descend below the brim into the pelvic cavity, in primiparæ, two or three months before labor." (See paper in *American Journal of Obstetrics*, 1887, and remarks in *Transactions of the American Gynecological Society*, vol. xii. p. 236.) Dr. King also maintains that convulsions scarcely ever occur in cases of shoulder- or cross-presentation in primiparæ or in multiparæ.

The argument is weakened by the fact that while eclampsia is four times more frequent in primiparæ than in multiparæ, shoulder presentations are between seven and eight times more frequent in the latter. The theory fails to explain the occurrence of eclampsia prior to the latter months of gestation; it fails too to explain why so many primiparæ escape the disease; and it alleges an earlier descent of the presenting head into the pelvis than is generally taught. In regard to the latter point, Depaul, referring in general to this change as one of the precursory phenomena of labor, remarks: "It may take place two, three, or four days before delivery; on the other hand, it may be present at the beginning of the ninth month and even before." Tarnier says, "eight or fifteen days before labor." Moreover, why does excessive distension of the uterus, as from pluriparous pregnancy, create liability to eclampsia? How, too, explain those cases in which pelvic deformity prevents normal descent of the uterus, for here too there is increased liability? A Dublin obstetrician (*Dublin Journ. Med. Sci.*, Sept. 11, 1843) says that there is little fear of eclampsia if the child does not present by the head.

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[1] *Revue méd. de Louvain*, 1883.

ued by Löhlein, states in reference to dilatation of the ureters, to which Halbertsma first called attention, that the compression must have lasted for a long time in order that the ureters should become as large as the finger: a temporary and rapidly-disappearing compression could not possibly cause such increase in size; now in only 8 cases out of 32 was there such dilatation.

But there are very serious objections to the acceptance of the theory which makes puerperal eclampsia depend upon renal disease exclusively. Probably not more than 1 woman in 5 who has albuminuria during pregnancy or in labor is eclamptic. Again, while the cases of this sort are not frequent, yet a long list[1] of eclamptics who were not albuminurics has been collected. It is therefore certain not only that renal disease is very far from being a constant forerunner of puerperal convulsions on the one hand, but that its absence on the other hand is no certain proof that such convulsions will not occur. Furthermore, as showing the unsatisfactoriness of our knowledge as to the essential cause of eclampsia even in those cases where the disorder is clearly dependent upon renal failure, the symptoms by no means correspond with those observed in what is known as uræmic intoxication. In the latter the patient is free from periodic attacks of convulsions; the coma constantly increases; there are no intervals of returning consciousness; and the temperature, instead of rising, falls: "a remission of the symptoms is only possible when the impediment to the elimination of urine disappears."

In some instances disease of the brain has been found the cause of the eclampsia. But in a still larger number, though small relatively to those dependent upon renal disease, the convulsions arise solely from reflex irritation. The centre of this irritation is usually the uterus, but in some instances the source is another organ—the bladder, for example. La Motte[2] has recorded a most instructive case where a woman seven months pregnant had violent convulsions; the abdomen was so large he could not at first believe that her pregnancy was not at its normal end. Learning she had passed very little urine for some days, and that it escaped drop by drop, he attempted to use a catheter, but, finding resistance, he introduced his finger into the vagina and ascertained that the resistance was caused by the head of the fœtus, which was pressing upon the neck of the bladder. He states: "I gently pushed the head as high as possible, and the moment the neck of the bladder was relieved of the pressure and the urine could have free exit there escaped such an amount that it was impossible to believe the bladder could contain such a quantity or that it could be so greatly dilated without rupture." The simple evacuation of the urine cured the convulsions, which before had threatened a fatal termination. Portal and other obstetricians have made similar observations. A case less conclusive than La Motte's, for other remedies were used before catheterization was employed, in which the convulsions were caused by accumulation of urine, has recently been reported by an American physician. The woman was attacked a few hours after delivery, and first veratrum viride was given in heroic doses without benefit; then chloral was twice given, first hypodermically, and the second time by the rectum; after the last dose the bladder was examined and more than "a gallon of urine" drawn. One with the knowledge of La Motte's case before him would probably have begun the treatment with the use of the catheter, and then possibly no other measure would have been necessary: in neither was there a convulsion after the bladder was emptied.

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[1] In Trousseau's *Lectures on Clinical Medicine*, Sydenham Society's edition, vol. i. p. 364, there is reported a case of post-partum eclampsia: the urine was repeatedly examined, and neither heat nor nitric acid ever gave rise to the least albuminous cloudiness.

Brooks (*London Lancet*, May 1, 1886) reports a case of eclampsia beginning two days before, and continuing six days after, delivery, without the urine being albuminous. This patient had right hemiplegia coming on slowly after a very long convulsion, and gradually disappearing after a few days: the hemiplegia was thought to be caused by a small hemorrhage in connection with the internal capsule of the opposite side.

[2] Observation ccxx.

Doléris and Butte[1] have found soluble toxic ptomaïnes in the blood of the eclamptic, which they believe may be the cause in some cases of the disease. It remains to be seen whether this discovery proves to be the essential cause in any considerable number of instances. But, as they claim, it enables us to put aside the exclusive idea of renal insufficiency, spasm, compression, old lesions of the kidneys, etc., and the purely nervous theory. Furthermore, it sustains the conclusion that eclamptic like epileptic convulsions do not depend upon a single cause.

If irritation of the bladder may be the exciting cause of eclampsia, how much more may the disorder arise from uterine irritation! Of course in this age, in which so many of the ills to which human flesh is heir to are attributed to microbes, it is not surprising that the microbian origin of eclampsia should be suggested.[2] Malcolm Black[3] refers to a case in which eclampsia was caused by half an ounce of fluid extract of ergot administered for hemorrhage: he adduces this case to sustain the theory that the convulsions result from a toxic agent in the blood.

Barnes[4] presents the following summary of his views as to the etiology of eclampsia: "Several conditions concur to cause the associated disorders. These are—(1) the hydraemic state of gestation leading to imperfect nutrition of the nervous centres, increasing (2) the normal nervous tension and irritability and (3) the normal vascular tension; with these comes (4) blood-poisoning from imperfect elimination of waste stuff by the kidneys and other emunctories."

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[1] *Nouvelles Archives d'Obstétrique et de Gynécol.*

[2] Delbou, *Lyon Méd.*, Oct., 1884.

[3] *Glasgow Medical Journal*, March, 1887.

[4] *Op. cit.*

So far as positive statement can be made of the etiology of eclampsia, there is no single cause. In most cases the disease results from toxæmia, the poisonous agent not always the same, but usually, in all probability, uneliminated organic constituents of the urine. But eclampsia may also be the expression of disease of the brain or of reflex irritation. The conclusion of Löhlein can be accepted, that no explanation of eclampsia has been fully established, and the disease certainly has more than one cause.

Our obstetric masters a generation or two ago looked upon cerebral or cerebro-spinal congestion as the cause, and, the theory admitted, the propriety of depletion was obvious. Dewees, as many in his day, taught that puerperal convulsions were epileptic, apoplectic, or hysterical, and, a strong determination of blood to the head being a premonitory symptom, he at once bled, purged, and put the patient on a low diet. Meigs asserted that the disease was caused by long-continued or violent determination of blood to the head, and Hodge, that in a large proportion of cases it resulted from congestion of the blood-vessels of the brain or from an actual effusion of serum or of blood into its substance or cavities. But now it is generally held that cerebral congestion is the consequence, not the cause, of eclampsia. A directly opposite theory was proposed in comparatively recent years—that known by the name of Traube-Rosenstein. According to this, the eclamptic patient being hydræmic, increase of arterial pressure causes serous effusion, and this effusion compressing the cerebral vessels, acute anæmia of the brain results. Convulsions are the consequence of anæmia of the bulb, and coma of anæmia of the encephalon. If this theory were true, eclampsia ought to be much more frequent, for an hydræmic condition is not uncommon in pregnancy; moreover, in cases of excessive hydræmia, that condition termed by Stoltz and his followers a serous cachexia, eclampsia is not common. No one who holds this theory could resort to depletion in the treatment, for thereby the hydræmic condition would be aggravated:

TREATMENT.—If a pregnant woman suffers from albuminuria, and especially if the urine is scanty, the administration of diuretics and restriction to a milk diet would be indicated. In this condition, too, pilocarpine has been found a useful remedy; a bath, the water being at a temperature of 98° to 100° Fahr., followed by drinking a glass of hot water and the use of other means to promote perspiration, will often prove very useful. Of course a daily free evacuation from the bowels should be had. Moreover, if we admit Halbertsma's theory of pressure upon the ureters as the cause of the renal disease, the woman ought to lie as little as possible upon her back, and indeed spend a part of the time each day in the genu-pectoral posture, thus relieving the ureters from pressure by the uterus.

But when a convulsive seizure occurs, whether in pregnancy or in labor or after it, curative treatment must be employed promptly. The first question for the practitioner to determine in the presence of puerperal convulsions is as to whether they are toxæmic or reflex. The use of the catheter will almost certainly give the answer, for renal disorder will reveal itself by scanty and albuminous urine, and on the other hand a profuse evacuation of normal urine will testify such disorder is not present, and possibly, too, prove that a distended bladder has been the cause of the eclamptic attack. During the paroxysm the patient should be kept from injuring herself, but efforts to restrain the convulsive movements, though kindly meant by friends, are useless and injudicious kindness: the most that should be done is to prevent her falling from the bed if she chances to be near its edge, and to prevent her biting her tongue; the latter is best accomplished by means of a suitably folded towel or napkin drawn firmly between her jaws and strongly held at each side, so that protrusion of the tongue is prevented.

After the paroxysm is over, except in case the attack comes after labor, bleeding to depletion is indicated if the pulse be full and strong and there are marked evidences of cerebral congestion. A stimulating injection, as of salt and warm water or turpentine with castor oil, may be given. But the most important treatment after the bleeding, if this has been thought expedient, is the administration of chloral: this agent lessens arterial pressure and reflex excitability and lowers the temperature, and therefore clearly meets the indications presented by eclampsia. It may be given by rectal injection, thirty to forty grains, for example, being rubbed up with the yelk of an egg, and a few ounces of milk added. The injection may be repeated, if necessary, in an hour. Some practitioners have successfully used much larger doses at a time—for example, a drachm and a half, or even two drachms, and in twenty-four hours two hundred and fifty, or even three hundred, grains have been given. Chloroform is given by inhalation, the quantity being small during the interval, but rapidly and freely increasing it at the first threatening of another paroxysm. If the patient can swallow, an active hydragogue cathartic may be given by the mouth—compound powder of jalap or elaterium, for example. In case she cannot swallow, a drop or two of croton oil may be put upon the tongue. Spiegelberg has given caution against chloroform narcosis immediately after venesection, because of the danger of too great lowering of the blood-pressure, for then it may cause death;

nor after having begun the use of the anæsthetic is it to be continued if the pulse becomes small and weak.

Morphia is a remedy which has been regarded with very great favor by some. In this country Dr. Clarke[1] of Oswego has especially advocated it. He directs giving to the eclamptic patient at once a hypodermic of one grain and a half; the dose is repeated after two hours if another paroxysm occurs, and if the patient be in labor another dose is given at the end of eight hours. Most practitioners do not employ such heroic doses. Zweifel regards the morphia treatment as especially adapted to cases where the attacks occur at long intervals. It or chloral would be used in preference to chloroform in eclamptic attacks occurring after labor. Professional attention to veratrum viride in the treatment of eclampsia was first directed by Fearn of Brooklyn in 1871, and since then testimony to its value has been given by many American practitioners, more especially in the South and West. One of the most recent contributions to the subject is by Jewett,[2] and the following are his directions as to dose, mode of administration, etc.; he uses the fluid extract of veratrum viride as prepared by Squibb, and he rejects administration by the mouth: "The average dose should be from ten to twenty minims. The smaller dose repeated in half an hour will doubtless suffice in the majority of cases. Yet I have usually preferred to place the patient at once fully under the influence of the drug. The guide to the dosage is the frequency of the pulse. Experience seems to justify the statement that no convulsion will occur while the patient is sufficiently under veratrum to hold the cardiac pulsations below sixty to the minute. The average time required to develop the full effect of a single subcutaneous injection is thirty minutes. If the desired result is not attained after that interval, the injection should be repeated in the same or smaller amount as may be required. Five-minim doses at longer intervals will suffice to maintain the diminished pulse-rate. I have rarely repeated the drug, however, after the circulation has been once brought profoundly under its effects, the total dosage seldom exceeding twenty to thirty minims of the fluid extract."

The value of pilocarpine has been attested by numerous practitioners. The remedy is administered by hypodermic injection; some have employed one-third or one-half a grain at a time, while others one-sixth at intervals of two hours. Zweifel does not seem to attach much value to it, and, as others have done, warns against its use in threatened pulmonary œdema. Hot baths have been especially commended by Breus, and the results in his hands were very satisfactory. Inhalation of oxygen has been employed, but not with striking success:

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[1] *American Journal of Obstetrics*, 1880.

[2] *Transactions of the American Gynecological Society*, vol. xii.

even if the results had been more satisfactory, the difficulty of promptly obtaining and using the remedy would forbid its general use. Nitrite of amyl has been recommended on theoretical grounds, but there are no clinical proofs of its value.

It may be said in general as to specific methods of treatment, whether by these or by any other means—*e. g.* bleeding, chloral, or veratrum viride—that it is only by the sum of many observations the truth is obtained: individual experiences may grossly mislead, for the cases themselves differ so greatly in their gravity, and it is necessary "in determining the value of remedies to carefully discriminate, individualizing the cases."

Obstetric Treatment.—If labor has come on, it is the obstetrician's duty to deliver as soon as possible, abstaining, however, from all violence. But if the convulsions occur in pregnancy, no uterine action being present, the question as to the induction of labor is presented. The objections to bringing on labor are that in some instances the convulsions cease and the gestation continues to the normal period, and that the induction of labor adds to reflex irritation: under this increased irritation, and considering the length of time which in some cases must elapse before the uterus can be emptied, the patient may perish before its accomplishment. Each case must be determined by itself; it is only after the failure of well-advised therapeutic means to control the eclamptic attacks, and with a reasonable hope of averting otherwise inevitable death, that the induction of labor is advisable.[1]

INJURIES TO THE CHILD DURING BIRTH.

These injuries, whether occurring in natural or in artificial labor, may be conveniently divided according to the parts of the child upon which they are inflicted. Thus, the first class will include Injuries of the Head and Neck, the second those of the Trunk, and the third those of the Upper and Lower Limbs.

INJURIES OF THE HEAD AND OF THE NECK—(*a*) *Caput Succedaneum.*—This, designated by Depaul sero-sanguineous infiltration, is a common but not a constant phenomenon of childbirth: if the labor is rapid, little resistance offered at the os uteri or any part of the birth-canal, and especially if the amnial sac is not ruptured until a short time before delivery, there is no swelling upon the part of the child which presents. The cause of the formation of the caput succedaneum is the absence of pressure upon that part of the child which is immediately in the free portion of the birth-passage, while all other parts are being subjected to severe pressure. As long as the waters are retained this swelling does not occur, or at least, if occurring in rare instances, it can only be very slight. Mauriceau attributed the caput succedaneum to the constricting os uteri acting as a ligature in preventing the return of blood and serum forced into this part of the head by uterine contractions—a view which Depaul regarded as presenting some truth.

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[1] Pajot very positively condemns the induction of labor, "for this requires quite a long time. Thus in fifteen cases at the Clinique last year in which labor was induced for various causes, the mean duration of the beginning of labor was eight to ten hours. But many times the period of time necessary to bring in play the uterine forces is much longer. Now, in very many cases eclampsia is determined within fifteen, eighteen, twenty-four hours" (*Arch. de Tocol.*, 1885). Considering that the disease itself tends to induce labor, probably the time necessary to excite uterine action is not so long in eclampsia as Pajot suggests. Moreover, by means of Barnes' dilators the duration of labor may be reduced to a very few hours.

While the tumor is usually developed during the dilatation of the mouth of the womb, and is then known as the primary caput succedaneum, it may also be formed at some other part of the birth-canal, when, the previous one having appeared, this is called a secondary one. In case of narrow pelvis, for example, the great difficulty in the expulsion of the child and the consequent slowness of the labor, the caput succedaneum is usually very large.

In most instances the swelling disappears in a few hours or in a few days after birth. Exceptionally, especially if rude or frequent "touching" has been employed, the surface of the tumor presents phlyctenulæ, which upon rupturing leave superficial ulcerations which may not heal for several days, or they may be starting-points of erysipelas or even of gangrenous inflammation. In still other instances phlegmonous inflammation of the tumor may occur, and this inflammation end in suppuration.

TREATMENT.—The great majority of cases of this sero-sanguineous infiltration require no treatment: if the swelling in any instance lingers, its disappearance may be hastened by the application of alcohol and water or of a solution of muriate of ammonia. Raw surfaces may be dusted with iodoform or boracic acid after they are thoroughly cleansed. Should suppuration occur, the treatment is the same as that of external abscesses appearing elsewhere.

(*b*) *Kephalohæmatoma or Thrombus Neonatorum.*—By this name is designated an effusion of blood between the periosteum and the bone, usually situated upon one of the parietals, upon the right more often than upon the left, but in some cases upon both, and in rare instances upon the frontal, the occipital, or upon one of the temporals. True kephalohæmatoma should not be confounded with the affection previously described, which by some authors is called kephalohæmatoma spurium.

The cause of this affection is by no means certain; to say that it is traumatic gives no explanation, for the cause of the traumatism is unknown. Godson[1] asserts that kephalohæmatoma is "most probably due to the constriction of the os during labor;" and Earle[2] attributes the majority of cases to this cause, though he correctly states that the affection has been observed after a pelvic delivery: in reference to the latter Bastaki[3] has recently reported an instance of it. The explanation adopted by Godson and Earle is without foundation: when we remember that the affection is not frequent, it is quite probable that it occurs relatively quite as often after pelvic as after vertex deliveries. Mildner[4] and Hecker held that the blood-effusion resulted from the coats of the blood-vessels being thin and easily ruptured, while Langenbeck and Ritter attributed it to the defective development of the external table of the bone.

The fact that a kephalohæmatoma having all the characteristics of the affection in the newborn may occur in children some years old is a conclusive argument against the hypothesis of a traumatism in labor.

FREQUENCY AND SYMPTOMS.—While most authorities speak of the affection as quite rare, Kleinwächter gives the proportion of 1 to 200–250. Kephalohæmatoma is rarely seen immediately after birth, but in most cases a period of one to three days intervenes before the swelling, which varies in size from a pigeon's egg to that of a small apple, makes its appearance. The tumor is elastic, fluctuates, the fluctuation being more distinct than that observed in case of an abscess, is without pulsation, and there is no increase in its size when the child is crying; the color of the skin covering it is not changed, presenting in this regard a marked contrast with the appearance of a caput succedaneum; and usually a bony margin surrounding the base of the tumor can be felt, but if the tumor is apparent at birth this osseous elevation will not be discovered until a few days have passed. Kleinwächter states that the swelling never goes beyond a suture or fontanelle, and when it is double there can always be felt an intervening suture or fontanelle. Bouchut,[5] however, asserts that while the effusion seems limited by the sutures, nevertheless it may cross over and extend from one bone to another; he also quotes the remarkable case of Ducrest, in which the effusion beginning upon one parietal bone extended to the biparietal suture, passed over it, then beneath the opposite parietal, between this bone and the dura mater.

PROGRESS.—In rare cases the swelling disappears in ten or twelve days, but in others it may remain for a month. In some instances suppuration occurs, and this may be followed by caries of the bone. If the affection is complicated by an internal kephalohæmatoma—that is, by an effusion between the dura mater and the bone—the child will be affected by convulsions and paralysis, and death result.

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[1] *Quain's Dictionary.* [2] *Journal of the American Medical Association.*

[3] *Archives de Tocologie*, September, 1888.

[4] See Kleinwächter's article on Kephalohæmatoma, *Real Encyklopædie der gesammten Heilkunde.*

[5] *Traité pratique des Maladies des Nouveau-nés, etc.*

TREATMENT.—Evacuating the collection of blood may hasten the cure, but this operation is objected to on the ground that infection of the wound may occur, and then greater danger to the periosteum results. Most practitioners, knowing that spontaneous cure is the rule, advise a temporizing course, and would not resort to incision unless the tumor remained of undiminished size for some time or unless suppuration occurred. Nevertheless, it is possible good results would be had from careful antiseptic aspiration of the tumor.

(c) *Wounds of the Scalp and of the Face.*—These injuries of the scalp may be contused, punctured, or lacerated, while wounds of the face are usually contused. Probably contusions are most frequently caused by the blades of the forceps, either because of their wrong application or because the instrument itself is badly constructed. As a rule, the blades of the forceps should be applied to the sides of the child's head, but in some instances such application is impossible. Another rule which ought to be regarded as golden is that the compression directly made by the instrument must be only sufficient to prevent slipping; but this rule is sometimes neglected, and the consequence may be more or less injurious. Nevertheless, the contusions directly caused by the forceps are generally quite superficial, and in a few days disappear. An antiseptic lotion may be applied twice a day.

Injuries to the eyes have been produced in face presentation by careless or rude touch: the fact ought to be sufficient to guard against the accident.

Punctured and incised wounds of the scalp have been made by the obstetrician in consequence of his mistaking the caput succedaneum for the bag of waters. Tarnier gives an instance of such a wound being the origin of a fatal erysipelas. In every case where the practitioner is in doubt in making the differential diagnosis let him pass one or two fingers above the swelling, so that he can directly touch the bones of the head, and then the difficulty will be removed.

A lacerated wound of the scalp has been caused by one of the blades of the forceps being thrust between the scalp and the cranial bones. Charpentier reports a case of this blunder, and I have met with a similar one, the attendant stating that he could apply one blade of the instrument very easily, but in attempting to introduce the other there was an obstruction caused by the head being attached to the uterus.

Sloughing of a portion of the scalp has been observed following some cases of spontaneous labor. Thus, Priestley[1] has reported a case of this kind resulting in death eight days after delivery: the labor was protracted for forty-eight hours because of a narrowed pelvic outlet. Lizé[1] of Mans states that in the case of a multipara forty years of age the bag of waters ruptured five days before the birth of her child, which presented by the vertex, but occupied an occipito-sacral position. Five days after delivery a slough involving almost the entire extent of the occipital bone appeared; three days subsequently it became detached and the child recovered. Bouchut[2] quotes from Lorain a case of gangrene of the scalp in a newborn child occurring in the service of Moreau. The mother was a primipara, and the labor lasted forty-eight hours, terminating spontaneously; the child died on the nineteenth day. Dr. Goodell informs me of a case in which an oblique application of the forceps was made—one blade being in relation with the right frontal bone, and the other with the left occipital—and the right anterior portion of the head was so bruised that sloughing occurred a few days after birth: after the detachment of the slough a fatal hemorrhage ensued.

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[1] *London Obstetrical Society's Transactions*, vol. i.

Depressions and fractures of the cranial bones, separation of their union to each other, fractures of the bones of the face, as well as disjunction of their articulations and joints, have been observed more or less frequently in cases of difficult labor, manual or instrumental—some of them, indeed, in spontaneous labor. Some obstetricians have asserted that depressions of the bones of the fœtal skull are always accompanied by fractures. This was the opinion of Danyau, of Lachapelle, and of Schroeder. But a case[3] given by Matthews Duncan seems to strengthen the view held by most obstetricians, that such depressions may occur without the bone being broken. The case was one in which a persistent impression was made on the right parietal bone by the finger of the accoucheur, who was endeavoring to cause rotation. The result was slight, short, but frequently-repeated epileptiform seizures, which lasted some time after the impression had disappeared, and were finally replaced by choreic movements. It seems hardly probable that the pressure of the finger produced a fracture of the bone.

Dugès[4] has given an instance of great depression in one of the parietal bones not followed by any serious consequences. The child was delivered by the feet through a pelvis of which the conjugate diameter was estimated at three inches and a quarter. Powerful traction upon the shoulders and upon the lower jaw was necessary to bring the head past the obstruction, and the parietal bone, which was in relation with the sacro-vertebral angle, presented a depression half an inch in depth and two inches in breadth. The infant was resuscitated with difficulty, then had convulsions, but in a few days was quite well, and in fifteen days the depression had entirely disappeared.

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[1] *Annales de Gynécologie,* 1875. [2] *Traité pratique des Maladies des Nouveau-nés, etc.*

[3] *British Medical Journal,* October 18, 1873.

[4] Quoted by Jacquemier: *Manuel des Accouchements,* Paris, 1846.

Minor impressions or indentations are sometimes seen, especially after the application of the forceps, and in rare instances such marks are permanent. But we must not be in haste to conclude that these indentations found upon the head of a newborn child are proofs of instrumental delivery, for Osiander[1] has stated that, having delivered a child by podalic version through a narrow pelvis, he found upon its head a depression into which the end of a forceps-blade accurately fitted; so that he himself would have concluded, had he seen a similar depression in another case, that the delivery had not been spontaneous, but by the forceps.

Fractures of the fœtal skull have been observed as the result of direct violence, as when a woman expels her child while she is standing and it falls on the floor. Or, again, a woman[2] near the close of the second stage of labor, the child's head being at the vulvar opening, threw herself out of the window, and several fractures of her limbs, as well as a fracture of the child's head, resulted. But apart from these cases in which the injury has resulted from direct violence and those observed in delivery, whether spontaneous, manual, or instrumental, in narrowed pelves, fracture may occur when the labor is in all respects perfectly normal so far as duration and facility are concerned. Thus, Dr. Charles West[3] has reported a case of an infant dying from convulsions nine days after birth, the labor having been an easy one and lasting only five hours. The mother had previously given birth to two living children, and these labors, too, had been normal. Yet at an autopsy of the third child a fracture of the right parietal bone was discovered, with effusion of blood between the cranium and dura mater, the effusion being more than half an inch thick and occupying the entire fossa of the bone. Dr. West states in his report that fractures of the skull have been known to take place during easy labors and wholly independent of any preternatural degree of ossification of the skull. Monteith[4] mentions having attended a case of perfectly natural labor in which the child had a fracture of the right parietal bone. There was a marked depression in the middle of the bone, and the fracture extended to the sagittal suture on one side and to the coronal on the other. It is quite apparent that a case such as either of these might give rise to medico-legal investigation or to unjust censure of the obstetrician.

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[1] Given by Cieslewicz, *Verletzungen des Fœtus durch den Geburtshelfer*, Halle, 1870. Cieslewicz has collected forty cases of fracture, fissure, contusion of nerves, laceration of muscles, separation of epiphyses, etc. occurring in labor; he also reports two of rupture of the longitudinal sinus.

[2] Quoted by Delore: "Fractures du Fœtus," *Dictionnaire encyclopédique des Sciences médicales.*

[3] *Transactions of the London Medico-Chirurgical Society*, 1845.

[4] *London Lancet*, November 14, 1874.

In regard to fracture of the bones of the cranium or face, or rupture of the joints of the maxillary symphysis or of the cervical vertebræ, or fracture of a vertebra—for it is claimed that usually the body of one is broken rather than two vertebræ separated as the consequence of great traction occurring in manual or instrumental delivery—an important question arises as to the amount of force which may be safely used either with hand or instrument. In illustration of the great force which has been employed in forceps delivery without injury to mother or child I quote the following from Dr. Peugnet.[1] He states: "I was called to Mrs. K——, a multipara, in labor with her third child. The first two were delivered by craniotomy. The vertex presenting R. O. A. and impacted between the sacrum and the pubes, the conjugate diameter of the superior strait greatly contracted, I applied forceps and had great difficulty in locking them. Dreading the laceration which might ensue in this case from side-to-side lever action, I concluded to rely upon direct and steady traction. My strength giving way, her husband held me round the waist, whilst the patient was held *in situ* on the dorsum by four women. In forty-five minutes I had the satisfaction of bringing the head down upon the perineum. The delivery was then speedily accomplished. Both mother and child, a girl, did well." The least that can be said in regard to this case is that the result was very remarkable, and it is doubtful if the practice pursued could be repeated in any considerable number of similar cases without injury to both mother and child.

Delore,[2] after remarking that the fœtal head may endure without injury a great compressing force if applied to a large surface, and if made by a regularly concave surface, as that of the blades of the forceps, states that from his experiments he found a compressing force of 100 kilogrammes (250 pounds) did not cause a fracture. But, on the other hand, if the blades slip, if the pressure is made upon a small surface, fracture follows the exercise of much less force. Further, a blunt, angular body, such as the sacro-vertebral angle, the spherical surface of which is described by a radius of two or three centimeters, produces a fracture with a force of 20 kilogrammes (50 pounds). As the force which is exerted in difficult labor is more than 20 kilogrammes (50 pounds), fracture results. Nevertheless, these results are not in complete accord with those of Goodell,[3] though, as will be seen, he is discussing the question of the amount of traction force that may be used in a narrowed pelvis without injury to the neck of the child. Nevertheless, the subject of injury to the bones of the head is also involved, and in only one instance, I believe, does he mention fracture of one of the cranial bones. He states that he has on several occasions delivered living children after throwing on their necks a weight of 130 pounds. He further says that, although exerting all the manual strength at his command, he has never seen the body part from the head. He mentions one instance in which there was not the slightest apparent injury to the neck though the sacral side of the head had been broken in. Further, in another case the force of traction upon the child's head, combined with suprapubic pressure, amounted to 200 pounds. Stone[1] has more recently reported a case of podalic version and delivery by traction through a narrowed inlet in which he put on the neck of the child all the force of which he was capable, using the pump-handle movement described by Goodell. The child was dead. There was no fracture of the bones of the head. The spine had parted in the upper dorsal region during the traction upon the trunk, which was necessary to cause the shoulders to come low enough to reach the arms. The cervical spine was not broken.

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[1] *Ohio Medical and Surgical Journal*, 1878.

[2] *Op. cit.*

[3] *American Journal of Obstetrics*, 1875.

Delore's conclusion as to the amount of force followed by fracture of the cranium of the fœtus is erroneous, or such injury ought to have been observed in all cases where a force even approaching 100 pounds was used. Champetier's[2] investigations as to the force that could be safely used in the delivery of the fœtus led him to the following conclusions, the first of which does not correspond with the results obtained by Goodell: First, there is danger of fracturing one of the parietal bones, whatever the method of extraction, if the total force employed reaches 35 to 40 kilogrammes (87–100 pounds), the infant being at term; 20 to 22 kilogrammes if it be premature. Second, the inferior maxilla of a child at term will bear, without rupture, a traction of 25 kilogrammes (62½ pounds). Third, the vertebral column of an infant at term was ruptured in three cases by a force of 50 kilogrammes (125 pounds).

If it is objected that these results have been obtained by experiments upon dead children, and therefore are not applicable to the force which may be exerted upon living ones, the answer of Matthews Duncan may be repeated. He, after consulting physiological and physical authorities, could say that a child living and one recently dead were the same as to tensile strength.

In this connection it is well to refer to the amount of traction which may be safely applied to the lower jaw of the fœtus, as stated by Duncan[3] from his own experiments. It will be observed that his results are not the same as those announced by Champetier. Duncan states: "It is now ascertained that a force of half a hundred weight (56 pounds) may, at least in some cases, be applied by dragging the lower jaw of the fœtus without producing any easily discovered injury of parts." He further says that compound dislocation would be almost certainly fatal, and in one of his experiments this injury was inflicted by a weight of 56 pounds. Not only does Duncan's statement as to the force which the inferior maxilla will bear without injury differ from that of Champetier, but the difference is still greater than that given by Delore, who makes this 40 kilogrammes (100 pounds).

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[1] *Medical and Surgical Reporter*, February, 1880.

[2] *Du passage de la tête fœtale a travers le détroit supérieur rétréci du bassin.*

[3] *London Obstetrical Society's Transactions*, vol. xx.

Fractures of the cranium usually involve the parietal bones, but they may also occur in the frontal, in one of the temporals, or in the occipital bone. Jacquemier first pointed out the separation between the squamous and the basilar portion of the occipital bone, to which some more recent writers[1] have directed attention without giving him just credit. He also stated that he had met with fracture of the occipital bone above the protuberance. Ruge,[2] referring to separation of the epiphyses between the squamous portion of the occipital bone and the articular part, states that Schroeder is the only one who has recently drawn attention to it; and, notwithstanding its importance in regard to the life of the child, this lesion is not referred to in classic works as one of the immediate consequences of extraction. The lesion may also occur in a narrowed pelvis, though the head present. In these cases there may be not only effusion of blood, but further compression from the squamous portion having its anterior inferior margin forced against the medulla. Lusk[3] states that he has seen a quadrilateral depression of the frontal bone following a comparatively easy forceps delivery, and the only cause that could be discovered was pressure of the blade of the instrument.

He also says that in the case of a flattened pelvis, where the head enters in the transverse diameter, it will sometimes happen, if the forceps is used, that the pressure of the blades bears directly upon the forehead and upon the occiput. This will be tolerated for a certain length of time, but when continued the pressure ultimately affects the medulla oblongata. It is then difficult to get the child to breathe, the respiratory sense being destroyed, and often the child is born dead as the result of such pressure. It is always important, therefore, to apply the blades in the oblique diameter if they cannot be applied to the sides of the child's head.

On the other hand, severe injury of the frontal bone has been observed without serious consequences. Thus Dugès[4] saw a child recently delivered whose left eye was almost completely outside the orbit, so great was the depression of the frontal bone; yet the infant did not have convulsions or any other grave symptoms. I have seen protrusion of the eyeball in a newborn child following fracture of the frontal bone by Hodge's forceps in a case of tedious labor in a primipara, the delay being from an occipito-sacral position. The child lived for a week. That an infant may survive very grave injuries in labor is proved by a case reported by Lamotte,[1] in which a surgeon in a case of shoulder presentation had torn away the arm and then performed a craniotomy, evacuating a large amount of the cranial contents; yet the child was born alive.

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[1] Thus Bednar (*Die Krankheiten der Neugeborenen und Säuglinge*, Wien, 1863) refers to it as a hitherto unobserved injury.

[2] *Bullétin de Thérapeutique*, from *Zeitschrift für Geburtshülfe und Frauenkrankheiten*, 1875.

[3] *Medical and Surgical Reporter*, 1887.

[4] Jacquemier: *op. cit.*

Zweifel[2] regards fissures and fractures of the cranial bones as of clinical significance only if a sinus be injured and consequent hemorrhage occur. On the other hand, Delore[3] asserts that all these fractures are grave, on the ground that they may be accompanied by contusions of the brain. Further, there may be hemorrhages between the bone and the periosteum, in the cavity of the arachnoid, or between the pia mater and the brain. If the solution of continuity be at the position of a sinus, there is frequently rupture of the vessel. He adds that in all cases in which the head has undergone severe compression from dystocia he believes hemorrhages occur. The significance of this last remark will be appreciated especially when we consider the remote consequences upon the mental condition of the child, as urged more especially by some English observers.

Injuries to the bones of the face are usually of the inferior maxilla. This bone may be fractured or separation of the mental symphysis may occur. Ruge mentions cases in which, in addition to injury of the bone, there were lesions of the soft parts—as, for example, tearing of the skin at the angle of the mouth, as well as of the mucous membrane of the pharynx, and rupture of the genio-glossus muscle. Yet if we fail to use traction upon the lower jaw in cases of difficult head-last labors, we miss what may prove an important means of delivery when other means fail. Some years ago in a case of narrow pelvic inlet, having vainly tried the forceps, I performed podalic version, and sought to deliver by traction, while a consultant aided me with suprapubic pressure. I am confident that I did not use the force which some operators have safely employed under similar circumstances, yet the cervical vertebræ gave way, either by separation or by fracture, and I found apparently nothing but the integument holding the head to the body. I then succeeded by traction upon the inferior maxilla, suprapubic pressure assisting, in bringing the head into the pelvic cavity.

That the head may be left in the uterus, the body being dragged away, is a fact proved by occasional instances in the history of obstetrics. In other cases the division has been made, not by rupture, but by cutting through the neck. An instance is reported[1] in which the obstetrician, failing to deliver the head in a case of shoulder presentation, after detaching the arm and bringing down the feet, performed decollation, and the head and the placenta remained in the uterus for forty days. Freund mentions a case in which the head was left in the uterus for ten years. In at least two instances, one given by Leishman and the other by Dr. Joseph Price,[2] the Cæsarean operation has been performed for the removal of the head left in the uterus, the body having been torn away.

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[1] *Traité des Accouchements*, 1726. [2] *Lehrbuch der Geburtshülfe.* [3] *Op. cit.*

Probably the most remarkable case of multiple injuries to the face has been recorded by Petit.[3] The face presented, rupture of the uterus occurred, and the woman died undelivered, though the forceps had been used. The autopsy of the child showed multiple separations of the bones of the face and fractures.

Paralysis of one of the facial nerves has been observed most frequently, but not exclusively, after the use of the forceps. In a paper read before the American Gynecological Society in 1885, I referred to eight cases of spontaneous unilateral facial hemiplegia, and also mentioned one case observed by Seeligmüller, in which the paralysis affected both sides of the face. But the disorder usually occurs from the use of the forceps, and is caused by the pressure of one of the blades at the stylo-mastoid foramen or a little in front of the lobe of the ear. Landouzy, who has best described this affection, remarked that in the infant the complete absence of the mastoid apophysis and the slight development of the auditory canal favor compression of the facial nerve near its point of emergence. According to Parrot and Troisier recovery usually takes place in six weeks in paralysis of the facial nerve caused by the forceps. Many cases, however, get well in ten days. Nevertheless, while recovery is the rule, it should be remembered that in some cases the injury is permanent.. Duchenne[4] refers to two patients, one fifteen years old and the other five years and a half, in each of whom the paralysis continued. It should also be observed that there may be facial paralysis in the newborn, caused by protracted labor and intracranial hemorrhage.

Injuries of the sterno-cleido-mastoid muscle have been observed by several practitioners. Torticollis of obstetric origin was explained by Stromeyer and Dieffenbach as resulting from improper application of the forceps, the muscle being bruised or torn. But this explanation is rejected by Saint-Germain as not plausible. A very large proportion of infants that have wry neck are born with pelvic presentation, and it is asserted that the traction asserted causes rupture of some fibres of the muscles; a hæmatoma follows, and finally contraction of the cicatricial tissue results in drawing the head into an unnatural position. One of the first references to tumors of the sterno-cleido-mastoid in the newborn was made by Melchiori[1] in 1862. He spoke of them as indurations of muscle sometimes met with in young infants, and to which he found no reference in authors. He met with this disorder four times, and he described the affection as an indurated plastic deposit. While he mentions temporary deformity of the neck, he does not speak of any case in which this was permanent. In referring to its etiology he suggests that compression of the muscle or laceration of some of its fibres may take place during labor. The next year both Dr. Wilks and Sir James Paget[2] met with cases of what they described as chronic induration of the sterno-cleido-mastoid. Another case of the affection was reported the same year by Dr. Harris; and thus the published cases in a few months numbered at least six. But no reference was made by any of the reporters to the previous observations of Melchiori.

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[1] *Obstetric Gazette*, from *Archiv für Gynäkologie*, March, 1883.

[2] "System of Midwifery," *Medical and Surgical Reporter*, November 19, 1887.

[3] *Annales de Gynécologie*, 1874.

[4] See Nadaud: *Des Paralysies obstétricales des Nouveau-nés.*

Bryant[3] in 1863 reported two cases of thickening of the sterno-cleido-mastoid. One patient was four, the other eight weeks old, when he saw them. In each instance the birth was with pelvic presentation. Probably in all the cases, or at least in a majority of them, the disease was hæmatoma. Nevertheless, Blachez[4] regarded these tumors as caused by an interstitial myositis in consequence of traction upon the muscle. He describes the tumor observed in one of his patients as elastic, almost painless, and the size of a pigeon's egg; it was situated in the right sterno-cleido-mastoid, and was not discovered until two or three weeks after birth, when the attention of the parents was called to it by the infant's keeping the head inclined to the right side. Zweifel recognizes injuries of the sterno-mastoid muscle in labor as a cause of torticollis. Professor Albert[5] of Vienna, referring to a child with torticollis, stated that the sterno-cleido-mastoid may become contracted during intra-uterine life or be injured during birth. In breech presentations and in difficult forceps delivery a laceration of this muscle may occur, and be followed by inflammation and contraction.

While such injury is more frequent after head-last labors, yet it may be met with when the vertex presents and the forceps is used. I have seen one case of this injury in an infant six weeks old brought to the Jefferson Medical College Hospital. From the physician, who came with the mother and infant, I learned that the labor was a very difficult one in consequence of the great size of the child and the mother being a primipara; the vertex presented, and delivery was finally accomplished by the forceps. A tumor situated just above the clavicle, and apparently in the muscle, could be both seen and felt at the time the child was brought to the hospital; a week subsequently it was much lessened, and I believe soon disappeared, and also there was gradual restoration of the function of the muscle.

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[1] *Medical Times*, London, August 9, 1862.

[2] *London Lancet*, vol. i., 1863, pp. 11, 236, and 313.

[3] *London Medical Times*.

[4] *Gazette hebdom.*, May 19, 1876.

[5] *Obstetric Gazette*, September, 1882.

Whether the tumor be a hæmatoma or the result of a circumscribed inflammation of the muscle, it gradually disappears, and probably in the majority of cases there is complete recovery of the muscle. Possibly the disappearance of the tumor may be hastened by the application of mild discutients or by slight counter-irritation, but the employment of active means is not indicated.

Injury to the Brain.—On October 2, 1861, a paper was presented to the London Obstetrical Society by Dr. Tyler Smith for Dr. W. J. Little, the title being, "Upon the Influence of Abnormal Parturition, Difficult Labors, Premature Birth, Asphyxia Neonatorum, on the mental and physical condition of the child, especially in relation to deformities."[1] In this paper—which, by the way, mentions two cases of wry neck attributed to difficult labors—the author says: "It is impossible not to connect the persistent affections of the intellect, of volition, and of organic life with the injury the several nervous centres suffered in some instances before the fœtus had reached the maternal pelvis; in others, whilst in transit through it; and in a third set of cases, where the fœtus was exposed to neither of these kinds of injury, it suffered from asphyxia neonatorum, suspended animation and its comcomitant congestions, effusions, capillary apoplexies of the brain, medulla oblongata, and spinal cord." Dr. Langdon Down, in discussing the obstetrical aspects of idiocy, stated that in a very large number of cases of idiocy the subjects were born after difficult and unusually tedious labors; and he held that if a neurotic tendency was present the tedious labor and suspended animation might determine the catastrophe, where otherwise all might have gone fairly well.

The following note from one of Dr. Little's[2] correspondents may be of some interest; it is in reference to a young man in regard to whom inquiry had been made by Dr. Little: "I have again ascertained he was asphyxiated for two hours when born, and that he has always been a weak creature, very slow in mental development, with difficulty in speaking, trembling and shaky, unable to fix his attention on a book, and a bit of a punster."[3] These views are further strengthened by the statement of Dr. Arthur Mitchell[4] that he believes there is a connection between difficult labor and idiocy.

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[1] *Obstet. Society's Transactions*, vol. xviii.

[2] *Obstetrical Transactions*, vol. iii.

[3] The final statement, "a bit of a punster," is conclusive as to the intellectual feebleness of this unfortunate man.

[4] *Medical Times*, 1862, 1863.

Intracranial hemorrhage is one of the rather rare accidents to the child in difficult labor. Dr. McNutt[1] has given 10 cases of this accident: in 7 the child presented by the vertex, and in 3 by the breech; paralysis occurred in all the latter, but in none of the former. The same writer has reported[2] the case of an infant presenting by the feet, the labor slow, and finally terminated by instruments; convulsions immediately followed the delivery, but disappeared after a few days, being followed by complete paralysis of both sides of the body, not including the face. The child never walked and never spoke; it died of pneumonia at two years and a half of age, and upon the autopsy "atrophy about the fissure of Rolando was present on both sides of the brain." She also has, in a previous paper[3] entitled "Intracranial Hemorrhage in Children," given from Dr. Allen Starr the case of a child ten years old who had never walked, and could not stand or sit without support until after it was six months old. Its birth was difficult, instruments being employed, and convulsions followed.

Dr. Hirst[4] has reported the case of a child dying two days after birth. It was the second of twins, and, presenting by the breech, its extraction was difficult, during which it was supposed the injury causing its death occurred: the autopsy showed a large mass of clotted blood under the dura mater, the hemorrhage having resulted from a rent in the longitudinal sinus.

According to Ross,[5] in the meningeal hemorrhages of the newborn the children are either born dead or in a condition of asphyxia, and often die soon afterward. If respiration is established, the infant lies in a comatose condition for some days or weeks, and during this time it suffers from frequent attacks of convulsions, which are generally most pronounced on one side of the body. In such cases the disease may prove fatal by coma, or the patient may gradually recover so far as life is concerned, but remain subject to one or other of the forms of spastic hemiplegia of infancy.

It is unnecessary to refer to the treatment of intracranial hemorrhage occurring in birth. It may be questioned whether podalic version and extraction are not attended, considering the history of some of the cases which have been referred to, with greater danger, so far as the brain is concerned, than vertex delivery.

Dr. Wharton Sinkler[6] states that a very large proportion of the cases of paralysis he has met with in infants have followed instrumental or prolonged and difficult labors. Hemiplegias are often met with in the newborn as a result of the use of the forceps: he mentions having seen a child with right hemiplegia, the mother stating that the child had been delivered with the forceps, and that immediately after birth there was a deep depression behind the left ear: he found upon examination of the child, then sixteen months old, that a depression still existed in the left mastoid process. The right leg was spastic and the movements of the arm limited and inco-ordinate. Spastic paralysis, and what is sometimes called double spastic hemiplegia, very frequently occur in children who have been born by the breech. These conditions generally persist during life, and are associated with a feeble condition of the intellect.

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[1] *American Journal of Obstetrics*, 1885.

[2] *American Journal of the Medical Sciences*, 1885.

[3] *Quarterly Bulletin of the Clinical Society of the New York Post-Graduate Medical School*, vol. i.

[4] *University Magazine*, October, 1888.

[5] *Handbook of the Diseases of the Nervous System.*

[6] *Medical and Surgical Reporter*, November, 1887.

Sinkler also states that in the cases of paralysis following difficult or instrumental labors the lesion is often an extravasation of blood over the motor convolutions—a meningeal hemorrhage. If the amount of extravasation is great, the prognosis is of course bad, but in some of the cases, especially where there is monoplegia, where there is paralysis of one arm alone, the child entirely recovers the use of the limb. Dr. Osler[1] states that the records of the Philadelphia Infirmary for Nervous Diseases contain 9 cases of palsy following delivery with the forceps; in 6 of these cases the child is said to have been injured by the instrument—some of the children, indeed, had scars from the injury—and in all the paralysis was either noticed at once or a few months afterward without definite onset.

INJURIES OF THE TRUNK.—The chief lesions of the trunk are: rupture of the connections between the dorsal vertebræ, or fracture of one of these; injuries to the abdominal wall by a badly-directed blunt-hook; effusion of blood in muscles, similar to those that have been referred to as occurring in the sterno-cleido-mastoid; retroplural hemorrhages along the spinal column in case rupture of this column occurs; hemorrhage into the abdominal or thoracic cavity; collections of blood beneath the capsule of the liver or of the kidneys; and rupture of one or both of the sacro-iliac joints. Ruge has collected 44 cases of injury to the fœtus occurring in extraction after version, and 29 of injuries in pelvic presentations. In the former there are 3 cases of rupture of the sacro-iliac joint. It is probable, as suggested by Zweifel, that some cases of ankylosis affecting this joint, of which the etiology is obscure, are to be attributed to injury in birth. Zillner[2] has reported a rupture of the sigmoid flexure occurring in labor.

Dr. W. H. Parish reports having seen a tear of the perineum in a newborn extending from the vulvar orifice through to the rectum, caused by the tip of one of the blades of the forceps which the practitioner had attempted to apply to an unrecognized breech presentation.

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[1] "The Cerebral Palsies of Children," *Medical News*, July 14, 1888.

[2] *Centralblatt für Gynäkol.*, 1885.

Injuries of the Arms.—In connection with these lesions, those of the scapula and clavicle, which belong to the arms rather than to the trunk, will be considered. Delore states that *fractures of the humerus* are more frequent than all others; as they are usually readily cured, and are generally caused by *mal-adresse*, they are rarely published. But he further says that this accident may occur in the hands of the most expert accoucheur, if the pelvis be contracted. They occur most frequently in the disengagement of the arms after podalic version, when extraction is necessary; and they may also happen in pelvic presentation, but usually, if we do not have to extract the child—that is, if the expulsion can be left solely to nature—the arms will not ascend, but remain applied to the chest. Smellie[1] states that he fractured the humerus in a case in which he turned and delivered by the feet. This is the only instance of injury to the humerus he gives, while he mentions three of fracture of the femur, two occurring in the practice of his assistants and one in his own.

All obstetricians agree that in bringing down an ascended arm it is important that no pressure be made until the internal angle of the elbow is reached, and that three or four fingers should be employed, and not one or two. Pajot regards it as important that the posterior arm should be liberated first. Küstner[2] describes separation of the epiphysis of the head of the humerus from the diaphysis as one of the injuries of labor which may be overlooked or falsely regarded as a luxation, a fracture of the neck of the scapula, or an injury to nerves. Fractures of the clavicle, separation from its sternal attachment, transverse fracture of the scapula, separation of the epiphysis of the neck of the scapula, injury of the acromion process, and dislocation of the humerus have been observed.

Fracture of the clavicle is most frequently caused by pressing directly with one or two fingers in the endeavor to bring the head through the pelvic inlet after podalic version or in pelvic presentation. McClintock, in one of his annotations to the Sydenham Society's edition of *Smellie*, observes: "Although Smellie gives no example of fracture of the child's clavicle during delivery by the pelvic extremities, yet in my experience it is a bone very apt to be broken by the manipulations of the accoucheur, more so even than the humerus; this may perhaps be explained by its greater degree of ossification."

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[1] Sydenham's Society's edition of Smellie's *Midwifery*, vol. iii. pp. 296, 297. This great obstetrician in the first volume remarks: "In laborious or preternatural cases, when considerable force hath been used in delivering the child, the whole body ought to be examined, and if there is any mark or contusion on the head it will disappear if anointed with pomatum and gently rubbed off or chafed with the accoucheur's hand; if any limb is dislocated or broken, it ought to be reduced immediately; luxations, though they seldom happen, are more incident to the shoulder than to any other part, the humerus being easily dislocated and as easily reduced. The bones of the arm and thigh are more subject to fracture than any other of the extremities; the first is easily cured, because the arm can be kept from being moved, but a fracture of the thigh-bone is a much more troublesome case, because over and above the difficulty of keeping the bones in a proper situation, the part is often necessarily moved in cleaning the child."

[2] *Ueber die Verletzungen der Extremitäten des Kindes.*

Paralysis of the Arm.—Sinkler recognizes hemiplegia as, in some cases, the consequence of injury at the time of birth, either from the forceps or from the pressure of a prolonged labor. Nadaud gives seven cases of paralysis of the arm attributed to the forceps; the first case of this injury reported is one of Smellie's. Jacquemier mentions an instance of paralysis of the deltoid following a long and difficult, but spontaneous, labor; the recovery was complete in fifteen or twenty days. He attributed the disorder to compression of the axillary nerve against the humerus at the point of its attachment to the deep face of the deltoid. Fasbender found in an infant soon after delivery a tumor as large as a pigeon's egg situated above the right clavicle; the hæmatoma gradually disappeared, but at first there was paralysis caused by nerve-compression. Delore suggests that paralysis may be caused by the rupture of a nerve-trunk near its connection with the spinal cord. He states that this accident is not rare in the newborn or in young infants as a consequence of traumatism; it is followed by incurable paralysis, which is compatible with life if an upper member only is affected. Disengagement of the extended arms in pelvic deliveries, and traction upon the axilla in delayed delivery of the body in vertex presentation—the traction in some cases being with the blunt-hook, in others with the finger—have resulted in paralysis of the arm. The same disability has occurred in a case in which the arm protruded in shoulder presentation and delivery was effected by podalic version.

Luxation of the humerus has in some instances been mistaken for obstetric paralysis. Further, it is important to distinguish between cerebral and traumatic paralysis. Duchenne[1] gives an instance in which there were both cerebral and obstetric paralysis, the latter consequent upon a fracture of the ulna near the elbow.

INJURY TO THE LOWER LIMBS.

Fracture of the femur may be spontaneous or consequent upon artificial delivery.

Meyer has recently[2] reported 2 cases in which spontaneous fracture of the femur was observed; in 1 a single femur was broken; in the other both femurs. In May, 1847, Dr. Vanderveer[3] reported a case of spontaneous fracture in childbirth. But probably more fractures of the femur are caused by the attempt to pull down a lower limb in pelvic presentation, when the presenting part is already partially in the mother's pelvis, before pressing up the presenting part or from the use of the blunt-hook or the fillet. Delore's experiments show that with the untired finger traction to the amount of 15 kilogrammes (37 pounds) may be made upon the groin, and this cannot break the femur. If a force of 55 kilogrammes (137 pounds) is exerted upon the femur, fracture occurs; if the force be perpendicular to the bone, the latter gives way with a pressure of 20 kilogrammes (50 pounds).

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[1] See Nadaud: *op. cit.* [2] *Archiv f. Gynäkologie.* [3] *New York Medical Journal.*

Again, the femur has been broken or separation of the epiphyses has been caused by traction upon the leg. A. R. Simpson mentions an instance in which podalic version was performed, the right lower limb brought down, and traction made. Subsequent examination showed that there were three fractures of the femur.[1]

Luxations of the femur, consequent upon obstetric operations, are exceedingly rare, according to Ruge. In 300 autopsies upon newborn infants he did not find a single true dislocation of this bone. Küstner, in referring to luxations of the hip, speaks as follows: "Göschen relates a case in which Langenbeck reduced such a luxation after the subject, a girl, was thirteen years old, and mentions in this connection that Stromeyer had met with twenty cases. The only possible way in which this injury could occur would be by sudden and violent force drawing down the limb, and then dislocation upon the ilium might result. But the force must be great. I have suspended to the leg of a child from six to ten minutes a weight of from 30–40 kilogrammes (75–100 pounds) without any injury to the joint."

THE TREATMENT OF OBSTETRIC PALSIES AND FRACTURES.—Of course it is of the greatest importance to prevent these accidents, and therefore this prevention will be first considered.

The employment of the obstetric forceps ought to be unequivocally indicated by the interests of the mother or of the child, or still more strongly of both. A suitable instrument should be selected, and then the application made, if possible, to the sides of the child's head. The force used in extraction ought not at first in any case to be great; indeed, in some instances where extraction is very difficult, the wise obstetrician will remove the instrument and wait until nature's forces have moulded the head, for there is little gain in dragging a living child through possibly a torn birth-canal when that child is by such extraction doomed to a remediless palsy or a hopeless idiocy.

It is also to be remembered that not only instrumental, but likewise manual, delivery may have serious consequences to the child, for, as Lamotte wisely said, "the hand improperly used is more dangerous than any instrument." If, for example, podalic version be necessary, it is important that the delivery should be left after it to nature, never resorting to extraction unless absolutely necessary.

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[1] *Edinburgh Med. Journ.*, 1880.

The proper method of delivering the head in head-last labor is a question of some practical importance in reference to the prevention of injury to the fœtus. In Cieslewicz's collection of cases of fœtal injury in labor there are several in which more or less serious consequences followed the delivery of the head by the Prague method. One of these, reported by Gusserow, showed at the autopsy complete rupture of the vertebral column and most of the soft parts of the neck, so that the head was attached to the trunk only by the vertebral arteries and the skin. Ruge, rejecting both the Prague and the Vienna methods, advises lifting the occiput up and bringing the face down, and carefully employed expression as least liable to injure the fœtus. The application of the forceps to the after-coming head will in some instances deliver an uninjured living child when manual extraction is attended with great difficulty and danger.

If interference is necessary in a pelvic presentation, the question between manual and instrumental means is presented. Dr. Barnes' method of decomposing the wedge and bringing down one of the lower limbs is not attended with the danger of fracture of the thigh which has so often followed the use of the blunt-hook, and in some instances that of the fillet. The application of the forceps to the pelvis is upheld by Miles and Lusk in this country, by Tarnier and a few other obstetricians abroad, but is rejected by most authorities.[1] However, as this matter is fully discussed elsewhere in this volume, it will not be given any more space here.

Facial paralysis of the newborn is usually upon one side only; in rare instances it is bilateral; in most instances the laming has followed a forceps delivery, though in a few instances the labor was unassisted; finally, it may be partial, but generally is complete.

If with the facial paralysis there is palsy of the internal parts of the mouth—if the velum palati, for example, on the affected side hangs down loosely, occupying a lower position than upon the sound side—the injury to the nerve causing the condition was not from external pressure, and it involves the trunk anterior to its entrance into the petrous portion. In these cases there is no encouragement to use any therapeutic means. But if the paralysis is only of the face, spontaneous recovery usually occurs within six weeks. Its persistence beyond this time indicates the use of electricity: Duchenne advises resort to this means at the end of a month,

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[1] For example, in the last edition of Schroeder's *Lehrbuch der Gebürtshulfe*, edited by Olshausen and Veit, Bonn, 1888, the following passage is found: "The application of the head-forceps to the hips is to be rejected; the pelvic forceps is falsely constructed in principle, and is entirely worthless."

Paraplegia in the newborn indicates, according to Nadaud, almost certainly a serious lesion of the cerebro-spinal organs, and the child soon dies. Paralysis of the arm in connection with the same condition of the sterno-cleido-mastoid, and associated with the formation of a tumor in the lower portion of the muscle, whether a hæmatoma or the result of inflammation, disappears with the spontaneous disappearance of the tumor.

Where paralysis results from a depressed cranial bone Dr. Nancrede[1] believes that trephining might be employed.

A fractured clavicle should be treated by fastening the arm, the forearm being flexed, to the chest by means of a roller bandage; so far as possible, the infant should be kept lying upon the back: the bone will be firmly united in seven or eight days.

Separation of the epiphyseal end of the head of the humerus from the shaft of the bone is an injury to which Küstner has called especial attention; the injury from which it results would, if applied to the arm of the adult, cause dislocation. The characteristic symptom is that when the infant attempts to move the arm the humerus rotates inward: the accident may easily be mistaken for a dislocation. It is advised by Küstner in the treatment of this injury that the epiphysis, now rotating outward, be brought in contact with the diaphysis, and then the arm is fixed by a bandage to the thorax in a position somewhat outward and backward.

Fractures of the humerus may be successfully treated[2] "by fixing the whole upper extremity with a moulded splint in a straight position. Fractures of the femur are more difficult to manage. Here sheet vulcanite, which can, by softening in hot water, be accurately moulded to the limb, had better be used, because it will absorb neither urine nor feces. An anterior splint should be made which will extend well up over the abdomen, and a posterior splint to reach from the buttock well below the knee, thus fulfilling the important indication of fixing the joints above and below the fracture. It only requires ten or twelve days for firm union to occur."

A. A. Johnston[3] has reported a case of labor in a primipara, the breech presenting, and so firmly wedged in the mother's pelvis that he had to use a blunt-hook. Upon examining the child immediately after delivery, he found a compound fracture of the thigh, the bone having been broken just below the great trochanter, the lower end of the bone projecting through the skin about one inch. The fractured member was put up in cardboard splints, and the infant placed in a rocking-chair instead of in a cradle, the legs of the child being fastened in a perpendicular position to a bar placed across the arms of the chair; the limbs were thus at a right angle to the body, which acted as a counter-extending force. At the end of two weeks the fracture was found firmly united.

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[1] *Medical and Surgical Reporter.*

[2] Nancrede.

[3] *Australasian Medical Gazette*, November, 1883.

Delore[1] states that he met with several fractures of the thigh when he had charge of the Maternité at Liège; he advises in the treatment of this injury the application of a salicylated bandage and placing the member at a right angle to the body.

SUDDEN DEATH DURING OR FOLLOWING LABOR.

Whether one believe, with the Roman emperor, that the death which is most sudden is that most to be desired, or place it, as is done in the rubric familiar to all, at the climax of earthly calamities, such event is always startling and usually most painful to the witnesses. This pain is greatest, the misfortune almost without exception the gravest, if a mother dies in childbirth or soon after. Many causes conspire to make such an event peculiarly sad. The abrupt severing of new ties, the loss of life in giving life, and the sharp contrast between an infant living and a mother perishing just when the former so greatly needs the loving care of the latter, are among these causes.

The obstetrician not infrequently suffers public reproach when such an event occurs in his practice, for people are slow to understand how that which is in the majority of cases a simple physiological process may have a fatal issue. Moreover, in some instances death can be averted if the practitioner, forewarned of its imminence, uses appropriate means; in others the prophecy of such event as possible, probable, or inevitable may protect his reputation; and in still other cases, if prophecy should fail—the event, casting no shadow before it, coming unexpectedly to him as to others—his ability to explain its cause is very important. It is therefore alike the duty and the interest of the obstetric practitioner to study carefully the causes of sudden death in childbirth and in the first part of childbed.

Constant supply of oxygen to the organism and the regular distribution of blood suitable for nutrition are the two essentials[2] for the continuing of life—in other words, the lungs and the heart must perform their respective functions, and thus the tripod of Bichat is replaced by a biped, for the brainless fowl lives, though it instantly perishes if deprived of heart or lungs. In most cases of sudden death the heart, the *ultimum moriens* of Galen, first stops—or, in other words, death is caused by syncope, not by asphyxia. If death begins at the lungs, the fatal event is usually slow in progress; nevertheless, it may then in some instances be sudden, as from pulmonary embolism, just as, on the other hand, cardiac death does not always occur even rapidly. In still other cases, lungs and heart may both fail, the failure of neither being the exclusive cause of death.

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[1] *Op. cit.*

[2] Strauss.

Without designing or desiring to classify the causes of sudden death as cardiac or pulmonary or cardio-pulmonary, when observed by the obstetrician, I shall present the chief immediate causes of sudden death during or after labor.

1. DEATH FROM MENTAL EMOTION.—The fact that syncope may be caused by a strong mental impression, as fear, anger, joy, or sorrow, is familiar to the profession as well as to the public. A reasonable supposition is that in such cases the impression upon the brain is first reflected to the bulb, then probably through the pneumogastric nerves the bulb itself arrests the action of the heart, and hence the sudden paleness, the cerebral anæmia, and the syncope.[1] Wundt, adopting Kant's classification of emotions into sthenic and asthenic,[2] says that the former kill by apoplexy, and the latter by cardiac paralysis, or rather by the interruption of cardiac function which energetic and persistent excitement of the inhibitory nerves of the heart causes.

Several examples of sudden death from great joy are recorded by Tuke in his well-known work,[3] and Montaigne has narrated[4] one of the most striking instances in which such death was caused by profound sorrow. The familiar lines uttered by Malcolm in *Macbeth* show that the great master of tragic poetry recognized the truth that deep grief might cause fatal syncope:

"the grief that does not speak
Whispers the o'erfraught heart, and bids it break."[5]

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[1] Strauss: *Nouveau Dictionnaire de Médecine et de Chirurgie pratiques*, t. 34.

[2] *Elements of Physiological Psychology.*

[3] *Illustrations of the Influence of the Mind in Health and Disease.*

[4] The story, as told by Montaigne in his *Essays*, is the following: "In the war that Ferdinand made upon the widow of King John of Hungary about Buda, a man-at-arms was particularly taken notice of by every one for his singular gallant behavior in a certain encounter, and, unknown, highly commended and lamented, being left dead upon the place, but by none so much as by Raisciac, a German lord, who was infinitely enamored of so rare a valor. The body being brought off, and the count, with the common curiosity, coming to view it, the armor was no sooner taken off but he immediately knew him to be his own son—a thing that added a second blow to the compassion of all the beholders; only he, without uttering a word or turning away his eyes from the woeful object, stood fixedly contemplating the body of his son till the vehemency of sorrow, having overcome his vital spirits, made him sink down stone-dead to the ground."

[5] The same great poet has, in his *Julius Cæsar*, represented Cæsar's death as not the consequence of injury inflicted upon his body, but of profound emotion:

"For when the noble Cæsar saw him stab,
Ingratitude, more strong than traitors' arms,
Quite vanquished him: then burst his mighty heart."

The greater nervous susceptibility of woman than of man, and its notable increase during pregnancy, would explain the special liability she would then have to be injuriously affected by a profound emotion, whether of pain or of pleasure. It has sometimes happened[1] that a premature labor has been thus caused, and in rare cases this labor has been soon followed by death. But such untoward results are probably, as a rule, only consequent upon powerfully depressing emotions or those which by Kant were called asthenic, such as great sorrow, grief, or fear suddenly occurring. In case death follows this premature labor, it may be explained as caused by exhaustion, or the immediate cause may be hemorrhage from uterine atony, this atony itself being the result of the prostrate condition of the system.

Chevallier has collected and narrated cases of sudden death occurring to puerperæ which he attributed to idiopathic asphyxia. But, as remarked by McClintock,[2] "some very competent authorities look upon the mortal affection described by M. Chevallier as merely a form of syncope." Undoubtedly the latter term is the correct one. It is remarkable that several of the cases adduced were those in which death followed a strong emotion—in other words, they were instances of fatal emotive syncope. One of these, for example, taken from Morgagni, was that of a multipara who after an easy labor was delivered of a girl, her husband and she both being desirous of a boy; the sex of the child was imprudently told her: she was affected with such deep sorrow that her pulse became weak and her skin cold, and in a few hours she died; the autopsy presented no satisfactory cause of the fatal result.

McClintock quotes from Travers the following case: " A young lady, happily married, impressed probably by some unexpectedly fatal occurrence in the circle of her friends, entertained from the commencement of her pregnancy a morbid fear of death in childbirth, which, although

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Both these quotations attribute the failure of the heart to its rupture; and this accident is quite possible from emotional causes. In Dr. Stroud's well-known work, *Treatise on the Physical Cause of the Death of Christ*, London, 1847, the author maintains the view that this cause was agony of mind producing rupture of the heart. In a recent volume by Sir Risdon Bennett, M. D., etc., entitled *The Diseases of the Bible*, London, 1887, this eminent physician discusses the subject and fully accepts Dr. Stroud's conclusion.

[1] Probably one of the earliest, if not the earliest, of all instances of premature labor caused by emotional disturbance, the labor being followed by immediate death, is that recorded in sacred history concerning the daughter-in-law of the high priest Eli. The great novelist and the great poet, whose pictures are true representations of reality, furnish similar examples. Thus, by way of illustration, in Scott's *Guy Mannering*, Mrs. Bertram, suddenly learning the loss of her little boy, and thus subjected to violent sorrow, has a premature labor, and immediately dies. In Shakespeare's *Pericles, Prince of Tyre*, Thaisa, the wife of Pericles, is far advanced in pregnancy when in the passage from Pentapolis to Tyre a storm arises, threatening shipwreck, and the fear of this brings on labor, and after its termination death rapidly ensues.

[2] *Dublin Medical Press*, 1852.

unwarranted by any indication, became, from its continuance and increasing strength, a source of anxiety to one of her immediate and confidential relatives. She was attended by a skilful and experienced accoucheur, who was also her relation. He assured me that the labor was in all respects easy and safe, and that not a single unfavorable circumstance attended it. The child was stillborn and imperfect. The mother died suddenly in six hours after delivery. Every region of the body was examined with care by an eminent anatomist, and presented the appearance of health."

Mordret has taken[1] from La Motte's *Observations* the case of a laborer's wife who had to accept, though greatly dreading, the services of this celebrated accoucheur in a difficult parturition. La Motte found an arm hanging from the vulva, and he readily performed version and delivered her of a dead child; the placenta too was delivered, but the woman was trembling, though she had no chill, and half an hour after the labor died without previous hemorrhage, pain, or any other appreciable accident. Mordret believes that the death was owing solely to fear.

2. Death may Result from Severe Suffering.—A temporary syncope from violent pain has been often witnessed not only in females but in males, not only in adults but in children. It is not wonderful that the sufferings of childbirth, if very severe or protracted, should cause sudden death. Mordret remarks that an acute and continued pain is the most active enervant, and many times women die in labor or soon after, and the fatal result cannot be attributed to anything else than the excessive pains of a long and difficult delivery. The elder Ramsbotham and Travers had previously expressed a similar opinion.

Winckel[2] refers to strong mental emotion, especially severe suffering, as a cause of sudden death, and states that Baart de la Faille has collected 13 cases of post-partum collapse in which neither embolism nor the entrance of air was probable, but in which, however, the entire complexus of symptoms had very great similarity to cardiac paralysis.

Dr. Lusk[3] lost a primipara two hours after delivery with forceps, and he attributed the death to "nerve-exhaustion and shock." Dr. Fayette Dunlap,[4] in the case of a patient dying a few hours after the termination of her labor, regarded exhaustion as the cause of the unhappy event.

3. Death may be Caused by Disease of the Heart.—Cases of sudden death from fatty degeneration of the heart have been reported by Purefoy[5] and Jenks[6] and others. That of Purefoy is as follows:

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[1] *De la Morte subite dans l'État puerpéral*, Paris, 1858.

[2] *Lehrbuch der Geburtshülfe.*

[3] *Journal of the American Medical Association*, 1884.

[4] *Ibid*, 1887.

[5] *Dublin Journal of the Medical Sciences*, 1855.

[6] *Transactions of the American Medical Association*, vol. xxix., address in obstetrics, "The Causes of Sudden Death of Puerperal Women." This address is a valuable

The subject was thirty-six years old and a primigravida. A short time before labor began she complained of difficult breathing and præcordial impression, and these symptoms increased in severity with the progress of parturition; she died during the first stage. At the autopsy the uterus and its contents were found in every respect normal; the os was dilated to the size of a crown-piece; the presentation normal. The abdominal viscera were healthy; the lungs were in a state of recent congestion; the pericardium contained about two ounces of reddish-colored serum, whilst the heart was much enlarged, being in its greatest length about nine inches and from four to five inches in breadth at its base. "This organ had undergone fatty degeneration to a considerable extent, with the usual softening of its muscular fibre, and thus, being unfitted for its office, had failed to fulfil its all-important function in the hour of need."

Dr. Alexander R. Simpson[1] has narrated the case of a multipara less than forty years of age who died two hours after spontaneous delivery, and the autopsy showed "a heart pale and soft and freely overlaid with fat:" he attributed the death "to the exhaustion attendant on the process of delivery, and the consequent failure in the action of a feeble, fatty heart."

Franz[2] has reported the case of a multipara who died just after the delivery of the placenta, complaining of cardiac distress; the autopsy showed a fatty and dilated heart. Darryau in 1852 also reported a sudden death from the same cause twenty days after labor.

Rupture of the heart has been in some instances the cause of sudden death of puerperæ. In a case reported[3] by Spiegelberg death occurred in five minutes three days after labor, and the autopsy showed rupture of the left ventricle as a consequence of acute myocarditis. In M'Nicoll's case[4] a woman, two weeks after delivery followed by normal convalescence, while getting out of bed, exclaimed, "Oh, nurse, something has given way! I'm fainting." She died in twenty minutes, and upon post-mortem examination there was found an opening half an inch long in the walls of the right ventricle, which were very thin—fatty degeneration of the heart existed, although not to any great extent.

In connection with the first case reported the views of Coste[5] may be stated. According to him, sudden death after delivery is due either to a hemorrhage or to a thrombosis of the pulmonary artery or to a myocarditis. As hemorrhage causes death more or less rapidly, and as, on

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contribution to the subject. Another excellent article upon the subject, from the pen of Dr. S. L. Jepson of Wheeling, W. Va., will be found in the *American Journal of Obstetrics*, August, 1872.

[1] *Contributions to Obstetrics and Gynecology.*

[2] *Memorabilien*, 1874.

[3] *Monat. f. Geburt.*, xxviii.

[4] *Lancet*, March 20, 1852.

[5] *De la Myocardite puerpérale comme cause la plus frequente de Morts subites apres l'Accouchement*, Paris, 1876.

the other hand, thrombosis of the pulmonary artery appears to be caused by a degeneration of the myocardium, we may conclude that sudden death after labor is almost always the result of myocarditis.

4. DEATH MAY BE CAUSED BY RUPTURE OF THE AORTA OR OF THE SPLEEN.—Henricius has reported[1] the case of a multipara thirty-eight years of age who, in the second stage of labor, the uterine contractions being good and her general condition excellent, had suddenly-occurring spasmodic contractions of the lower jaw and of the members for a few seconds, and then died. The forceps was used five minutes after the death of the mother, and a child delivered which was with difficulty resuscitated. The autopsy showed rupture of the aorta, which was attributed to increase of blood-tension caused by the violent uterine and abdominal contractions on the one hand, and on the other simultaneous reaction of the heart against this obstacle.

Spontaneous rupture of the spleen is a rare accident, but it has been observed in pregnancy and during labor or after: it is unnecessary to state that such rupture is impossible without some change in the structure of the organ, and that it is rapidly mortal.

Whitney[2] has narrated the case of a woman eight months pregnant in whom the accident occurred immediately after taking a meal.

Sir James Simpson[3] has reported three cases of ruptured spleen. The first was that of a woman to whom the accident occurred in the sixth or seventh month of pregnancy; the second patient a week after delivery made some unusual muscular exertion, complained of severe abdominal pain and exhaustion, and died in a brief time; the third had been delivered with forceps, and within two hours after was dead: an autopsy in each case proved the nature of the accident.

Dr. Hubbard's[4] patient, a multipara who had been living in a malarial region and had great enlargement of the spleen, died six or seven hours after the spontaneous termination of her labor: the spleen weighed four pounds.

Carl Schwing[5] has reported a case of death from rupture of the spleen during labor: abdominal section was at once made, but the child was dead.

5. DEATH MAY BE CAUSED BY SOME ONE OF THE ACCIDENTS OR COMPLICATIONS OF LABOR.—Thus a patient may perish in eclampsia from acute asphyxia, though usually when asphyxia is the cause of death in this disease it is gradual, or it may be rapid, but rarely sudden. Inversion or rupture of the uterus may be immediately fatal in either case from hemorrhage or from shock, or probably in most cases from the two combined. Hemorrhage during labor, both when the

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[1] *Centralblatt für Gynäkologie*, 1884.

[2] *Boston Medical and Surgical Journal*, 1868.

[3] *Edinburgh Medical Journal*, 1866.

[4] *Boston Medical and Surgical Journal*, 1870.

[5] *Centralblatt für Gynäkologie*, 1880.

placenta occupies its normal site and also when it is previous, and hemorrhage after labor, may be the cause of sudden death.

6. PULMONARY THROMBOSIS has in several instances caused sudden death, but usually this accident does not occur in the earlier period of childbed, and it is generally preceded by phlegmasia alba dolens. The unhappy victim may have taken the erect or sitting position after having been recumbent for days or weeks, or made other slight exertion, and death come suddenly almost as if from a thunderbolt.

But death may be caused by embolism just after labor as a consequence of artificial thrombosis in a uterine vessel. Herman and Brown have reported the following case: An intra-uterine injection of a solution of perchloride of iron was used for post-partum hemorrhage, and the woman died, the death being attributed to an embolus from a thrombus in the uterine vein.[1]

7. DEATH MAY BE CAUSED BY THE ENTRANCE OF AIR INTO THE UTERINE VEINS.—Churchill, who almost alone among writers of works upon obstetrics very fully considers the subject of sudden death in the puerperal woman, states[2] that the absorption of air by the uterine veins was suggested by the younger Legallois in 1829, and by Ollivier in 1833, as being possibly the cause—at least of some—of the sudden deaths after delivery. Hervieux, after a full consideration of the subject and the presentation of cases of death apparently from air-embolism,[3] gives the following conclusions: 1. The incontestable reality of cases of sudden death from the presence of gas in the circulatory system of lying-in women. 2. The impossibility of attributing the presence of these gases to cadaveric cause—that is, to beginning putrefaction; the proved chemical identity of these gases with the gas of the blood, and the probability of their spontaneous development during life; the necessity of attentively watching lying-in women who have had severe uterine hemorrhage, and, although the introduction of air by the uterine veins has not been proved, the duty of the practitioner not to resort to intra-uterine injections except with the greatest reserve and rigorously conforming to all the precepts of art.

Hervieux's scepticism as to the entrance of air into the uterine veins is not now at least the voice of the profession, for numerous cases have demonstrated the fact. Thus in the patient[4] of Olshausen there was employed while she was in labor a uterine douche to hasten effacement of the cervix; she complained of pain, raised herself up in bed, gave some deep inspirations, and died in a minute. At the autopsy, made eight hours after death, bubbles of air were found in the cardiac vessels, in the uterine veins, and in the inferior vena cava. In Litzmann's case four uterine douches were given with Mayer's pump to induce premature labor; suddenly the woman became livid, and died in a few seconds. The post-mortem, made sixteen hours after death, showed bubbles of air in the uterine veins and in the ovarian and renal plexuses. Gunz has reported the case of a girl twenty years of age who was found dead in her room, having between her limbs an irrigator, the canula being in the vagina. She was found to be three months and a half pregnant, and the death was shown to have resulted from the entrance of air into the veins, the canula having penetrated the cervical canal. Spontaneous entrance of air is illustrated by the following case: A secundipara, twenty-five years of age, was after an easy labor delivered of her child while lying upon her side; she was then turned upon her back, gentle massage used, and the placenta was expelled. The face suddenly became livid, the respiration labored, the pulse weak; after vomiting a little mucus and after slight convulsive movements she became collapsed, and died. At the autopsy the uterus was found as large as the head of a child, and its walls relaxed. In compressing the posterior wall and the fundus of the uterus at the place where the placenta had been attached fine crepitation was heard; when the organ was thrown into water a great number of small bubbles of air escaped. The parts of the uterus near the cervix did not appear to contain air, nor did the veins of the broad ligament, the ovarian veins, or the vena cava.

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[1] *Obstetrical Journal of Great Britain and Ireland*, January, 1880.

[2] *Theory and Practice of Midwifery*, 6th ed.

[3] *Maladies puerpérales*.

[4] For these cases see Braun on "Sudden Death from the Entrance of Air into the Uterine Veins," *Wien. med. Woch.*, 1883.

Another instance is the following: Cordwent has given[1] the history of a primipara, twenty-eight years old, who was delivered while standing of a living male child, which fell to the floor, dragging the placenta and membranes with it. A "gurgling" was heard by the attendants, and the woman died almost immediately. At the post-mortem air was found in the uterine wall at the fundus, in the coronary vein, and in the right heart.

Winckel,[2] in referring to the entrance of air into the uterine veins as a cause of sudden death, remarks that in an examination during labor, in the removal of the placenta from the vagina, in the introduction of the hand into the uterus for the purpose of removing the placenta, the introduction of air is almost inevitable, and that sometimes the contained air escapes with a quite audible sound. He also refers to the fact that if the os uteri be closed and decomposition of retained material occur in the cavity, gas may enter the circulation.

Madden,[3] in a paper upon "Sudden Death soon after Parturition," gives among other cases that of a woman who had been delivered the previous day with forceps, and who sat up to urinate, and then took some warm whey; a few minutes afterward, while talking to the nurse, she changed countenance, hiccoughed once or twice, and expired almost immediately: the death was attributed to the entrance of air into the uterine sinuses.

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[1] *St. George's Hospital Reports*, London, 1873.

[2] *Op. cit.*

[3] *American Journal of Obstetrics*, August, 1871.

Krukenberg[1] has suggested it probable that air may enter in case of Cæsarean operation when the placenta lies directly in the line of incision.

Lauffs has collected[2] 43 cases of air entering the uterine veins. In 17 the accident was caused by injections into the birth-canal, 18 were spontaneous, and 8 resulted from the formation of gas in the uterus: 39 of the 43 were fatal, and the presence of air was proved by the autopsy in 31.

8. Sudden Death may be Caused by an Affection of the Respiratory Organs.—Mordret quotes from Devilliers a case in which death occurred during labor five or six minutes after sudden aggravation of the symptoms of pulmonary congestion. At the autopsy no other lesion than congestion of both lungs was found. La Motte has narrated a case in which death occurred suddenly after labor from a severe attack of asthma, and Depaul one in which the cause of the fatal result was pulmonary emphysema. Instances of puerperæ dying from pneumonia or from pleuro-pneumonia have been recorded, but in these cases the death was rapid rather than sudden. Pulmonary apoplexy, however, may cause sudden death.

Warren[3] has published a case of death a few hours after labor resulting from pulmonary œdema.

Dr. S. Salisbury[4] had a patient die two hours after her third labor from pleural effusion, the left pleural cavity being filled, compressing the lung. Symptoms of pleuritis had first appeared about a week before, but were not serious enough to interfere with her being up and attending to household affairs.

There have been thus presented the chief causes of sudden death during or after labor. It is necessary to add a brief statement of cases of sudden death from exceptional causes or from those which were conjectured or entirely unknown.

Merriman, under the head of "Dystocia Syncopalis," has given the following report of a case of sudden death in which probably the autopsy would have failed to show any organic lesion: "An accoucheur was once attending a woman in labor with her first child. Soon after it commenced, and during his absence, she fainted without any obvious cause. On his return the circumstance was mentioned; but, as by this time she appeared perfectly recovered, no further notice was taken of it, and she was safely delivered without any other unusual symptom. On the third day after delivery she took a dose of aperient medicine, and, while in the act of relieving herself, fell back and immediately expired. Probably no care would have prevented this unfortunate event. It was perhaps inexpedient to give the patient a purgative under such circumstances — a clyster would have been a more appropriate remedy, and at all events an erect posture should have been strictly forbidden."

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[1] Schroeder.

[2] *Ueber Eintritt von Luft in die Venen der Gebärmutter bei und nach der Geburt.*, Bonn, 1885.

[3] *American Journal of Obstetrics*, 1884.

[4] *Boston Medical and Surgical Journal*, 1870.

Charles has recently reported[1] a case in which the death was attributed by him to uræmic poisoning.

Spencer has reported[2] the case of an anæmic primigravida who had eclampsia and premature labor, giving birth to twins; sudden death occurred, and the autopsy showed a large quantity of blood in the abdomen, no rupture of the uterus, but a gastric ulcer, with rupture of an artery.

One of Madden's cases[3] is that of a woman who died soon after delivery, and the autopsy showed the cause of death to be hemorrhage from rupture of a varicose ovarian vein.

The late Dr. Charles D. Meigs in 1849 directed[4] professional attention to heart-clot as a cause of sudden death in the puerpera, claiming to have discovered that this accident most commonly depends "on the sudden coagulation of the blood that occupies for the time the right auricle of the heart, and in some of the cases even that which is in the ventricle and the pulmonary artery." His theory was that in consequence of hemorrhage the coagulability of the blood being increased, sudden exertion caused fainting, and in consequence thereof "the blood is likely to become concrete if it but come to a stop in the auricle."

Playfair in 1871 reported[5] a case of sudden death after labor which he attributed to a thrombus in the right side of the heart and pulmonary arteries.

Haughton has reported[6] the case of a multipara who ten days after normal labor left the bed to evacuate the bowels; sudden syncope occurred, and in forty minutes she died. There was no post-mortem, and heart-clot was suggested as the probable cause of death.

Dr. Fordyce Barker states[7] that "observations have demonstrated that clots may form both in the pulmonary artery and in the right cavity of the heart as a primary lesion."

Pathologists have not settled the question as to the formation of a primary thrombus in the right side of the heart and in the pulmonary arteries, some denying its occurrence.

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[1] *Journal d'Accouchements.*

[2] *Medical Press and Circular*, 1873.

[3] *Op. cit.*

[4] *Philadelphia Medical Examiner.*

[5] *London Obstetrical Society's Transactions*, vol. xiii.

[6] *Cincinnati Lancet*, 1855.

[7] *Puerperal Diseases.*

Therefore the spontaneous formation of a cardiac thrombus may be regarded as doubtful—reference is not had to such coagulation as may occur in dying—and too often death from heart-clot is a veil for our ignorance. So, too, cardiac paralysis or heart-failure merely reveals a symptom, a consequence, or an effect, the cause being unknown. While usually the cause of sudden death in labor or in the puerperal state may be ascertained, in rare instances this is impossible. Thus Dr. Jackson[1] narrates the case of a woman who ten days after her delivery, while walking across the room, fell down dead, but nothing was found at the autopsy to explain the death.

The preventive TREATMENT of this accident needs only brief consideration. Some of the cases here presented carry their own moral, plain to him who reads; in other instances no human science and skill could have averted the fatal issue—death was inevitable.

It is important that the obstetrician should know not merely the physical, but also the mental, condition of his patient; knowing the latter, he may, by prudent speech and thoughtful suggestion and wise tact, defend her from perils to the body that come through the avenue of the mind. Coleridge said that he was the most successful physician in the treatment of nervous diseases who was most successful in inspiring hope. No matter how learned an obstetrician may be in a knowledge of the phenomena of labor, how great his experience, and how wise and skilful in the employment of artificial aids to labor, he makes his qualifications still greater if he knows how in all cases to inspire hope, dissipating gloomy forebodings, and sedulously guarding patients against all injurious mental influences, whether ignorant suggestions of meddlesome friends or true statements made inappropriately in manner or time. If ever a woman needs to have both sympathies and antipathies respected, it is when enduring, or when she has just endured, the perils of childbirth.

So far as the actual management of labor is concerned, certain conditions liable to cause death demand artificial delivery. If the woman has been upon her side during the expulsion of the child, and then turns upon her back, this change should not be made without compression of the uterus through the abdominal wall during it. Intra-uterine injections must never be used unless the indication is unequivocal, and then preferably by an irrigator rather than by the ordinary syringe; so, too, injections of a solution of one of the iron salts are to be regarded as a last resort—they are rarely if ever required. Aspiration by puncturing the cardiac ventricle in air-embolism, recommended by some, has never yet been tried in the human subject, and would probably only prove a desperate experiment. Abrupt changes of position, and especially sitting up in the early days of the puerperium, even for evacuation of bladder or bowel, are to be avoided: such precaution is especially required if the woman was anæmic before her labor or has had post-partum hemorrhage or hemorrhage during the labor. Mental and physical rest is nature's instinct and nature's law for the puerpera.

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[1] *Boston Medical and Surgical Journal*, April 7, 1870.

DEATH OF THE MOTHER IN LABOR OR IN THE LATTER PART OF PREGNANCY.—CONDUCT OF THE OBSTETRICIAN.

Cases of spontaneous expulsion of the child after the death of the mother, not only when in labor, but also in pregnancy, have been reported. Aveling[1] has collected 44 of these. Some in this collection must be regarded as extremely doubtful, as, for example, the following: "Rudolph Camerarius tells us of a Spanish inquisitor who caused a pregnant woman to be hanged in 1551. Four hours after the death of the unhappy mother, while still hanging on the gibbet, two living children fell from her womb."

So too, the statement made in Aveling's paper, "After the death of its mother a child may continue to live in the uterus for many hours," is, in the light of the results obtained by artificial post-mortem deliveries, most improbable.

Spontaneous post-mortem delivery is usually caused by accumulation of gases from decomposition in the abdominal cavity, causing such pressure upon the uterus that its contents are expelled. Some, however, have claimed that at least in a few instances the expulsion of the fœtus resulted from the contractile power of the uterus still existing for a time after death, while the resistance of the birth-canal is lessened. Of course in an age when the old doctrine of a child escaping from the uterus by its own power was still held, the birth of a living child after the mother's death was plain.

Expulsion of the fœtus after the death of the mother is, of course, a very rare occurrence, and still rarer are the instances in which the expulsion occurred soon enough after that death for the child to be living. Therefore it is a universally-received law of the profession that artificial post-mortem delivery should be employed in all cases in which the child is living and capable of living after its extraction. The writer of an essay upon this subject has wisely taken as its motto, "Quem servare potuisses, non servasti, occidisti." Six hundred years before the birth of Christ, Numa Pompilius enacted a law directing that the bodies of women dying in pregnancy should be immediately opened, his object being thus to save citizens for the state. Very probably post-mortem artificial delivery was much older, for in the mythology of Greece the stories of the birth of Bacchus and of Æsculapius, each of these being removed from a dead mother by that which subsequently became known as the Cæsarean operation, point to an earlier date.

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[1] *London Obstetrical Society's Transactions*, vol. xiv.

The law of Numa Pompilius[1] was observed in Venice in 1608 and in 1722; and in 1749 the king of Sicily punished medical attendants with death who omitted the operation upon pregnant women soon after they expired.

Hubert observes that the Church merely reproduced the injunction of the Roman law in the following decree of its ritual: "Si mater prægnans mortua sit, fractus quam primum caute extrahatur."

Of course the child must be living and capable of continuing to live after its extraction to justify this operation. A fœtus born at four months may live for an hour or more: Cazeaux has given an instance in which life continued for four hours. The fœtus born at five months lives still longer, while one born at six months may live from one to fifteen days. Considering that we cannot know with absolute certainty the time in pregnancy when the mother's death occurs—the gestation may be a few days or even a few weeks longer than supposed, and thus the child be undoubtedly viable—we do well to adopt the rule given by Duer[2] in his elaborate paper: "Artificial removal of the child should be done in otherwise favorable cases which have attained to the neighborhood of the sixth month of pregnancy," for, though this is extreme, we will thereby be prevented from allowing a viable fœtus to perish in the abdomen of a dead mother on the ground of the gestation not having continued long enough. Moreover, we should remember, as pointed out by Tarnier, that the usually accepted period of viability, seven months, ought to be shortened, since by the employment of the couveuse and of gavage many a child born under seven months has been saved.[3]

Obstetric writers in referring to post-mortem Cæsarean operation are very positive in urging its early performance. Thus, Spiegelberg has stated that, generally speaking, not more than ten minutes must elapse between the death of the mother and the extraction of the fœtus, although there are instances on record in which living children were delivered at a greater interval and recovered. Schroeder said that it was only exceptionally a child extracted more than ten minutes after the death of the mother lived; and Zweifel holds that a post-mortem Cæsarean operation can only be successful when performed immediately or only a few minutes after the death of the mother. In Duer's valuable table, including 55 cases, the time that elapsed between the death of the mother and the removal of a living child was in 40 as follows: between 1 and 5 minutes, including "immediately" and "in a few minutes," there were 21 cases; between 5 and 10 minutes, none; between 10 and 15 minutes, 13 cases; between 15 and 23 minutes, 2 cases; after 1 hour, 2 cases; and after 2 hours, 2 cases. In addition to the last 2 cases given in this collection, it may be stated that Hubert has recorded a third case in which a living child was extracted from a woman who had been dead two hours.

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[1] Aveling. [2] *Amer. Journ. of Obstetrics*, vol. xii. [3] *Cours d'Accouchements.*

In those instances in which a living child has been removed at a longer period after the death of the mother than the child usually survives, and especially when that period lasts as long as an hour, there may possibly be some doubt as to the precise time of the mother's death being accurately known, for it may not have occurred as soon as it was believed to, and therefore the survival of the child was not so extraordinarily prolonged.

In determining the question as to whether the child is probably living we may be assisted by considering the cause of the mother's death. Thus if her death be from uterine hemorrhage or rupture, or if it be from eclampsia or from rupture of the heart or of a large blood-vessel or of the spleen, most probably the child is dead. So too, if the mother should die gradually, the child in most cases dies when she dies, or even before.

Hearing the fœtal heart-sounds is conclusive as to the life of the child; but the opposite conclusion must not be drawn from our failure to hear them, for in rare instances these have been unheard during the entire pregnancy, and then a living child has been born. In those cases, however, in which the fœtal heart-sounds, after having been heard normal in force and frequency, have become irregular, weak, either with their frequency greatly increased or lessened, and finally ceased, the obstetrician has witnessed the dying agony of the fœtus and extraction is not indicated.

In regard to the method of delivery, if the labor be so well advanced that extraction with the forceps or by podalic version can be promptly done, one or the other should be selected. It has happened in the use of the forceps in these cases that an apparent has been mistaken for a real death, just as a similar error has been committed in the performance of the Cæsarean operation, though of course the error in the latter is a more grievous one.

But in case the labor is in progress when the mother dies, and the child cannot be at once delivered through the natural passage, or if death occur in pregnancy, the only resort is the Cæsarean operation. In its performance the practitioner will be guided by the same rules and use the same precautions as if he were operating upon the living subject.

Not only is post-mortem Cæsarean operation a recognized means of delivery, but also its performance ante-mortem has been advised by

Löwenhardt under certain circumstances; that is, during the agony when a delay until the mother is dead would probably result in the death of the child. This proposition has received the indorsement of Spiegelberg: he has, however, added this counsel: "A conclusion should never be arrived at except after consultation with another accoucheur, nor should the step decided on be carried out except with the consent of the nearest relatives of the pregnant woman." While on theoretical grounds this practice may be justified, it seems extremely doubtful if most would not revolt against it as inhuman. We are required to perform a grave operation upon a dying woman, which adds to her suffering and probably shortens her existence. Better than the consent of friends would be her consent, obtained previously when she is informed that the disease from which she is suffering will probably be fatal before her pregnancy ends, and the hope of saving her child by the proposed operation made known to her.

Diseases of the Mother with Reference to Labor.

In general it may be asserted, as was stated by Desormeaux and Dubois more than half a century ago, it is rare that a woman is so enfeebled by disease that spontaneous expulsion of the fœtus, when all else is favorable, is impossible; the suffering consequent upon uterine contraction evokes from the economy a high degree of energy, which often, however, may be followed by collapse. The woman suffering with pulmonary tuberculosis frequently has an easy labor, partly from the diminished resistance of soft parts, and partly too from the fact that the child is, from imperfect nourishment, usually under size.

As a general rule, in serious disease of the respiratory organs the child should be delivered artificially, generally by the forceps. So too in case of meningitis observation has shown that the uterine contractions increase the patient's suffering, and even may cause convulsions, no renal disease being present; and therefore in such a case prompt artificial delivery is indicated.

Cardiac lesions may present great danger in labor. Authorities generally agree that the most frequent form of disease of the heart observed in pregnant women is mitral insufficiency,[1] but mitral stenosis is more grave, according to both Macdonald[2] and Porak. Marty's[3] statistics include 15 of aortic insufficiency, 5 of aortic narrowing, 65 of mitral insufficiency, 3 of mitral and aortic insufficiency, 40 of mitral narrowing, 51 of mitral narrowing and insufficiency, and 25 of mitral and aortic narrowing and insufficiency. In 13 cases the mothers died, and in 11 the children were stillborn, while several of the children died soon after delivery.

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[1] Zweifel, *op. cit.*, refers to a woman who in the fourth month of pregnancy, when about lying down upon her bed, suddenly fell to the floor, and very soon expired: the autopsy showed absolutely no change, and no other cause of death than mitral insufficiency.

[2] *Chronic Disease of the Heart in Reference to Pregnancy and Parturition.*

[3] *Des Accidents Gravido-cardiaques*, Paris, Thesis, 1876.

Obstetricians agree that cardiac disease does not contraindicate the employment of chloroform in labor, and indeed some assert that the presence of the disease invites the use of an anæsthetic. Very great prostration of the woman, either during or after labor, is best counteracted by frequent hypodermic injections of sulphuric ether. Macdonald[1] taught that all legitimate means ought to be used to lessen the effects of the down-bearing efforts, and therefore the judicious and timely application of the forceps, or, in suitable cases, the performance of version if the second stage of labor happens to be in any way prolonged. In case the quantity of amnial liquor be great, the early rupture of the membranes is indicated, so that the cardiac space may be less encroached upon by the uterus.

Winckel[2] states that in 8000 deliveries during the last seven years there were 22 cases of cardiac disease, 1 only of the women dying; but 14 of the 22 were primiparæ, in whom any serious complication from cardiac disease in pregnancy, in labor, or during the lying-in is altogether exceptional.

The subject of mitral stenosis in relation to the third stage of labor is the subject of a valuable study by Dr. Berry Hart.[3] He observes in the course of his paper that mitral stenosis is in itself a serious cardiac disease apart from any pregnancy, inasmuch as the weak left auricle soon fails in its increased duty, the lungs become engorged, and the right side of the heart dilated. He holds that if free hemorrhage does not occur during the third stage of labor, there is returned to the right side of the heart the extra amount of blood before accommodated in the uterine and placental sinuses; hence the right heart is distended and pulmonary engorgement is present. He advises the tincture of strophanthus if circulatory disturbances are present in pregnancy; this medicine is to be continued during the labor, delivery is to be accomplished as soon as possible, and during it chloroform is used. In the management of the third stage of labor no ergot is to be used, and the occurrence of hemorrhage is favorable, while its absence is often followed by serious symptoms. Should the circulation become embarrassed, as shown by irregular action of the heart or by dyspnœa, the strophanthus is to be pushed and dry cups applied over the heart.

More recently Ballantyne[4] has published an interesting paper upon "Mitral Stenosis in Labor and the Puerperium."

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[1] Op. cit.

[2] Op. cit.

[3] Edinburgh Medical Journal, February 1892.

[4] Ibid., March 1892.

THE FORCEPS.—EMBRYOTOMY.

By EDWARD P. DAVIS, A. M., M. D.,

PHILADELPHIA.

THE FORCEPS.

THE obstetric forceps may be simply defined as an instrument composed of two blades, designed for the extraction of a living child.

Each blade consists of a cephalic portion adapted to the contour of the fœtal head, and an external portion terminating in a handle; about midway between the extremities is the appliance used for maintaining the blades in apposition, commonly called the lock. In the early forceps the cephalic portion of the blade was solid; in later forceps an ovoid aperture, the fenestra, has been constructed, whose longer axis is parallel with that of the blade which contains it.

HISTORICAL.—The word "forceps" is derived from the Latin *formus*, warm, and *capere*, to seize. Virgil[1] describes the Cyclops as handling iron with the forceps while working at their forges at Mount Ætna, and Ovid also mentions its use as a tool.

The idea which first suggested its construction was the substitution of an instrument for the human hand; and this idea is strikingly apparent in several of the early models of obstetric forceps. The earliest instruments to which obstetricians had recourse when the hand failed were those used in the interests of the mother only, and were hooks. Hippocrates possessed an instrument for removing the fœtus from the mother; Soranus, among his seven instruments for craniotomy, possessed a hook; Celsus had a similar instrument; and in Pompeii such hooks were found among exhumed instruments.

In the eleventh century Avicenne,[2] a celebrated Arabian obstetrician, employed hooks when manual extraction failed, and expressed the possibility of extracting a living child with them. Ambrose Paré (1549) constructed three hooks with which to perform delivery. And in 1554, Jacques Rueff[3] of Zurich invented, among other instruments, his *forceps longa et versa*, with the declared intention of delivering a living child.[4]

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[1] *Georgic*, Liber iv. 173–175.

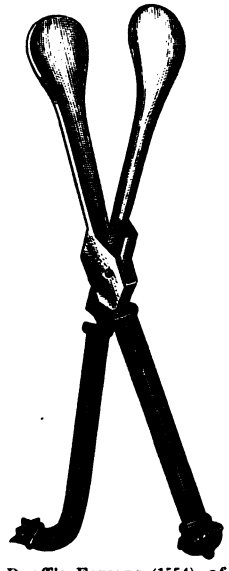
[2] Ed. 1608, p. 942.

[3] Chereau: "Forceps," *Dict. d. Sciences médicales*, Paris, 1877.

[4] Aveling (*The Chamberlens and the Midwifery Forceps*, London, 1882) denies the merit of Rueff's invention, claiming that he selected his forceps, with other instruments, from craniotomy instruments already existing. Aveling likewise rejects Palfyn's claim as an inventor.

This was the first expression of the inoffensive and conservative function of the forceps. Shortly after, in 1561, Franco invented a valved tractor, resembling a speculum, designed for application to the head of the child without destroying its life. It will be observed that Rueff's forceps (Fig. 7) possessed in an undeveloped form the essential characters of the modern instrument. The cephalic portion of the blade was expanded to cover a considerable surface upon the head, the blades crossed, and the handles were adapted for a firm grip. But the merit of his invention lay in the establishment of the forceps as a conservative instrument. Up to this time the arrival of a "man-midwife" had boded the death of child or mother, or both, as he was never summoned until natural delivery failed, and his only resource, in head presentations, was the hooks so fatal, at best, to the child. The seventeenth century, however, was destined to bring to the notice of obstetricians the celebrated Chamberlen (or Chambellan) family, English obstetricians for three generations. Pierre Chamberlen (1601–83) received degrees at Padua, Oxford, and Cambridge, and was physician-in-ordinary to royal personages of England. He was a facile inventor in various fields, and communicated to his sons, Hugh, Paul, and Francers, obstetricians, the knowledge of the Chamberlen forceps. Hugh Chamberlen visited Paris in 1670, hoping to realize a fortune by the invention. He sought Mauriceau, a famous obstetrician of that day, and begged a trial of his instrument. He was given a case of contracted pelvis, which he asserted he would deliver in a quarter of an hour. After three hours of violent effort he desisted from exhaustion. Mother and child did not survive twenty-four hours, and post-mortem examination revealed a ruptured uterus. With surprising boldness he revisited Paris six months after this failure, and proposed to sell his secret to the prime minister for a large sum. His reputation was not savory in Paris, and he returned to London, where he shortly afterward published a translation of Mauriceau's *Observations sur la Grossesse*, in which he claims the forceps as the invention of his father, his brothers, and himself. He also proposes to keep this invention a family secret.

Fig. 7.

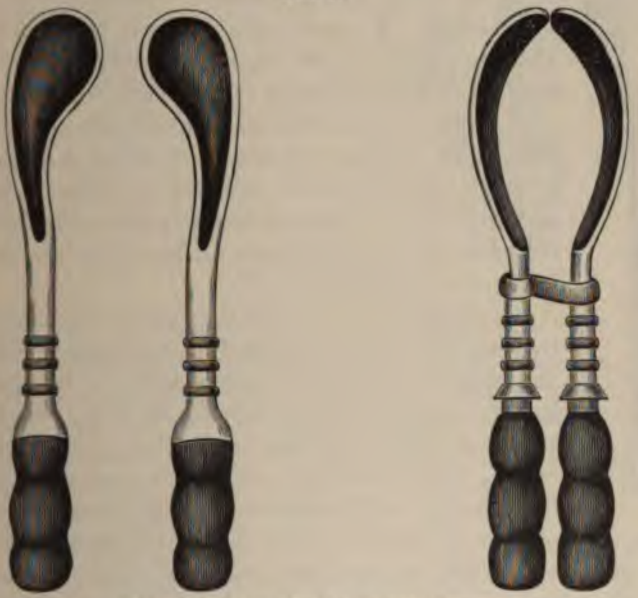


Rueff's Forceps (1554), after Chereau.

Resolved to seek a new field of gain, Chamberlen visited Amsterdam in 1693, and sold his secret to Roonhuysen at a large price. The latter succeeded in carrying on a monopoly of the forceps in Amsterdam for sixty years (1693–1753). In 1747 he obtained a municipal decree obliging every practising obstetrician in Amsterdam to purchase the secret, and with his associates formed an autocratic medical association which ruled obstetric practice without compunction.

Meanwhile, a forceps resembling the Chamberlen instrument was in process of introduction and use by Drinkwater, an English physician (1668), by Van Salingen at The Hague, and Slevogt of Jena (1709). Chamberlen is mentioned in 1697 as having delivered a child with his *speculum matricis*, probably his forceps.[1] In 1716, Palfyn, a Dutch surgeon, exhibited to the Academy of Sciences of Paris a forceps of his invention, often styled "Palfyn's hands." It was severely condemned by La Motte, a contemporary authority, but the blades were joined by Heister of Altdorf in 1739, and it was highly esteemed by him and others. A plea for priority in the invention of the forceps has been entered in favor of Palfyn, but it is difficult to assign an absolute priority to any one in the invention of an instrument so gradually developed and by so many different men. That Palfyn's forceps, as joined by Heister (Fig. 8), was fairly efficient, and recognized and used as a conservative instrument, there can be no doubt. The problem of joining the blades was also solved by Dusée (1733), who was the first to provide an efficient fastening by means of a mortise with a pin, after crossing the blades. In 1734, Giffard and Chapman fenes-

FIG. 8.



Palfyn's Forceps, joined by Heister (Chereau).

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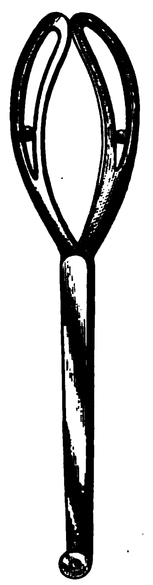
[1] Chereau: *loc. cit.*

trated the cephalic portion of the blades,[1] and Chapman wrote in defence of the use of the forceps in 1735.[2]

The Amsterdam monopoly justly came to grief in 1732 through Rathlaw, an obstetrician of Amsterdam, who refused to purchase the secret of Roonhuysen. He communicated his grievance against the monopoly to a friend, a physician at The Hague, and he in turn, by questioning a former student of Roonhuysen, discovered the secret. The student, Van der Swam, had lived with Roonhuysen in 1697; his curiosity regarding his master's secret had impelled him to make frequent efforts to examine the forceps, but without success. While attending a case Roonhuysen was summoned by the burgomaster, and, putting his instruments in a bag, he hastily concealed them. He had been observed by Van der Swam, who opened the bag in his absence and took the design of the forceps.[3]

FIG. 9.



Rathlaw's Forceps (1732).

Rathlaw's "tire-tête" (Fig. 9), made by him in Paris in 1732, was a modified Chamberlen-Roonhuysen forceps. A wordy war between Roonhuysen and Rathlaw ended in the triumph of the latter in 1747 and the permanent defeat of the Amsterdam monopoly.

In addition to his labors with the forceps, Roonhuysen sought to enrich the armament of the obstetrician by a vectis, but even this is assigned by critics to his son-in-law Bruin, and there remains to him only the doubtful glory of a participation in the conscienceless enterprise of Chamberlen.

All doubt as to the exact form of the Chamberlen forceps was cleared away in 1818 by the discovery of hooks and instruments formerly the property of the Chamberlens at a house in Essex occupied by them from 1633 to 1715. Among other instruments Carwardine found four models of the forceps.[4] It will be seen (Fig. 10) that Chamberlen had constructed an instrument closely resembling the short forceps of the present day. Had cupidity and selfishness not ruled his actions, he might justly have claimed one of the noblest achievements in medicine: as it is, he furnishes an example of shameless greed which has earned the condemnation of the majority of medical historians.

Until 1747 the forceps possessed only the cephalic curve, but at this time Levret invented at Paris a forceps, longer than that ordinarily used, to which he gave a pelvic curve. His model has been generally retained by French obstetricians to the present day. Levret (Fig. 11) made no attempt to cover the iron, but roughened the handles for a firmer grip. In 1752, Smellie lengthened the forceps in use in England, covered the handles with wood and the remaining portion with leather, and joined them by the lock which appears at present in the Simpson forceps. He retained the short forceps (Fig. 12), and considered its use very desirable in delayed labor, urging that short forceps could be applied often without the patient's knowledge, as the fear of operative interference was very great. Smellie hoped to popularize the instrument by his short forceps, thus removing one of the great obstacles to the acquisition of skill in its use.

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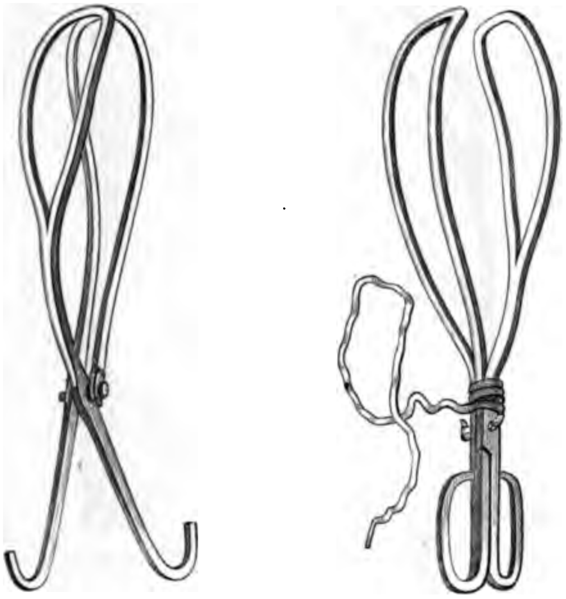
[1] *Cases in Midwifery*, London, 1754.

[2] *A Treatise on the Improvement of Midwifery*, London, 1735.

[3] Chereau: *loc. cit.*

[4] *Medico-Chirurgical Transactions*, vol. ix.

FIG. 10.



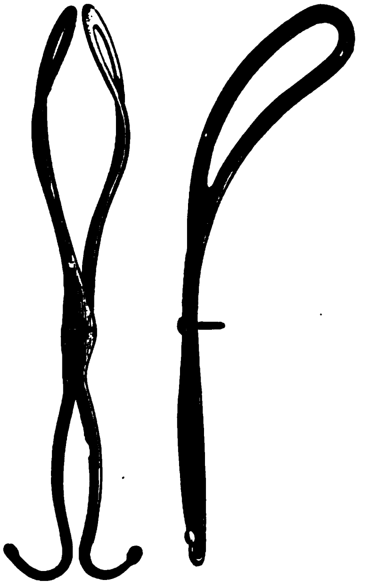
Chamberlen's Forceps.

The gradual extension of the knowledge and use of the instrument was such at this period that modifications followed each other with great rapidity: as many as fifteen different models of forceps, devised in the year 1833, represent the greatest inventive activity.

The need for long forceps was felt by Levret and Smellie; the dangers attending the application of the forceps at the pelvic brim were recognized by Smellie; and axis-traction was perhaps foreshadowed by Stein of Cassel (1767), who prolonged the fenestræ of his long forceps toward the lock, that he might pass through this space a band of pliable material, and thus make more advantageous traction.

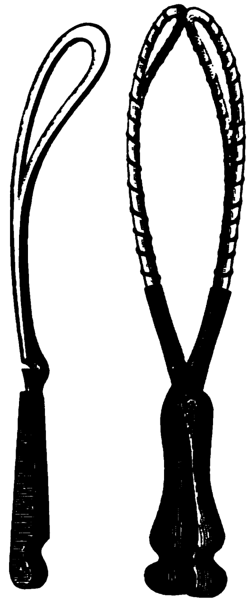
A forceps with the English lock and a moderate pelvic curve was introduced in Vienna by Boër (1793), and continued in use for many years in the Vienna Hospital. In 1802, Brünninghausen invented the

FIG. 11.



Levret's Forceps.

FIG. 12.



Smellie's Forceps (Lusk).

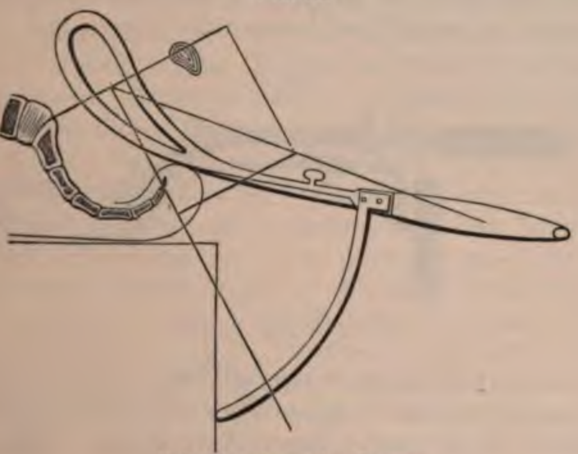
German lock, which exists at present as modified by Naegele. Among the curiosities called forth by this period of invention was a forceps called Audibert's "aids to memory," containing, engraved upon the handles, the pelvic diameters and various useful data; and also Bernard's *forceps assemblé*, intended for the simultaneous introduction of both blades. In 1801, Thenance of Lyons constructed the Lyons forceps, parallel, joined by a band near the usual location of the lock, and further united by a metal fastening at the extremities of the handles; they remained in use at Lyons for many years. Assalini (Milan, 1811) devised similar parallel forceps. Naegele in 1853 perfected the lock and forceps which bear his name, and gave the German obstetricians their favorite instrument.

But the problem of the direction in which traction should be made when the head failed to descend continued to arouse the efforts of obstetric inventors, and in 1867, Hamon devised a retroceps for preserving and perfecting flexion by grasping the occiput. He was preceded by Hubert (1860), who invented an axis-traction instrument in which the axial force was applied by a bar extended in the arc of a circle perpendicularly downward from the handle near the lock (Fig.

13). In 1868, Moralès devised a forceps possessing a perineal curve in addition to the usual cephalic and pelvic curves.

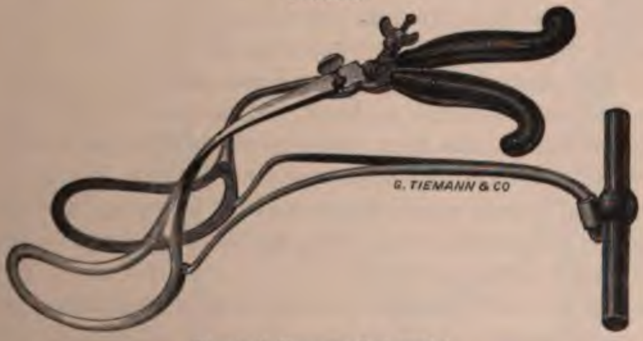
It remained, however, for Tarnier (1877) to present to the Academy of Medicine of Paris the forceps which bears his name, and which is most used at the present time for axis traction. His original model (Fig. 14) possessed three curves, a pair of curved traction-rods, and, in addition to the usual French lock (with mortise and pin), a device for regulating the compression of the child's head. He has subsequently abandoned the perineal curve in his later instruments (Fig. 15).

Fig. 13.



Hubert's Axis-traction Forceps.

Fig. 14.

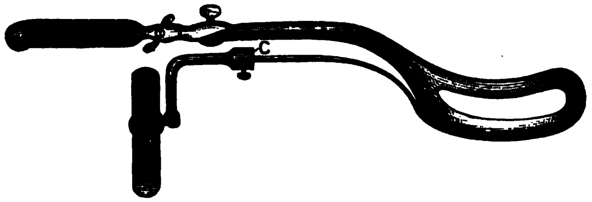


Tarnier's Forceps, first model.

The History of the Forceps in America.—As might naturally be expected, the forceps first used in America was that brought from England and France. It does not appear that the aborigines possessed any instrument for accelerating delivery resembling the forceps, and their efforts were confined to changes of posture and external pressure (Englemann).

Obstetricians were gradually divided into two classes by their views regarding the principles governing the application of the forceps. Those who applied the blades to the sides of the pelvis, grasping the head without regard to the relation between the forceps and the cephalic diameters, adopted the Smellie-Simpson model, while those who adopted the six cephalic positions of Baudelocque endeavored to accommodate the instrument to the head in its various positions. Hodge's forceps, justly styled by its inventor "the eclectic," was constructed on the model of Baudelocque, and represents the practical application of the belief that the forceps should be applied to the head and not along the pelvic walls.

FIG. 15.



Tarnier's Forceps (modified).

Elliott and Bedford have popularized the Simpson model; the studies of Davis of London in perfecting the cephalic portion of the blades have modified American instruments, as is seen in the forceps of Wallace and the short instrument of Sawyer. Axis traction has been chiefly effected by the long forceps ordinarily used; Tarnier's forceps has been modified by Lusk. Minor modifications have been made in abundance, but they have served for little else than to attract attention to the names of their authors. Indeed, Parvin[1] mentions an "original" forceps which figured with its inventor's name in a textbook, but never passed beyond the shape of illustration, its actual construction never having occurred.

FORCEPS OF THE PRESENT DAY.—A brief illustration of the forceps in use at present by the greater number of obstetricians in different countries will be useful in explaining the origin of American models.

The short, straight forceps, after Chamberlen's model, is most used in England. In America this instrument is used infrequently, Simpson's and Sawyer's short forceps, of this variety, being chiefly employed. Long forceps, possessing the pelvic curve of Smellie and Levret, are in general use among obstetricians of various nations. By the term "forceps" is commonly understood in America various modifications of these original long models. The number of such modifications, devised to satisfy the preferences of operators, is so great that for practical purposes only typical instruments can be described.

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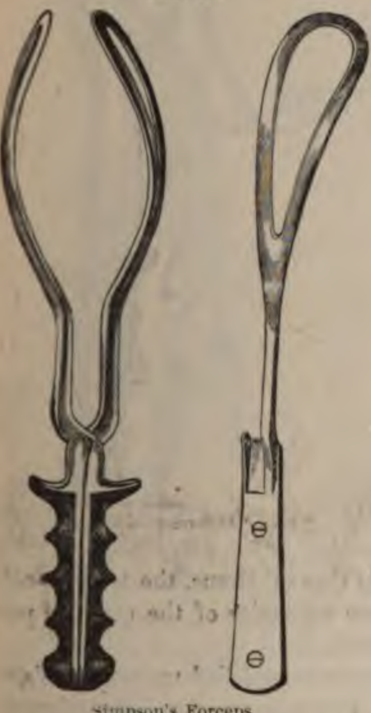
[1] *Obstetrics*, 1886, footnote p. 618.

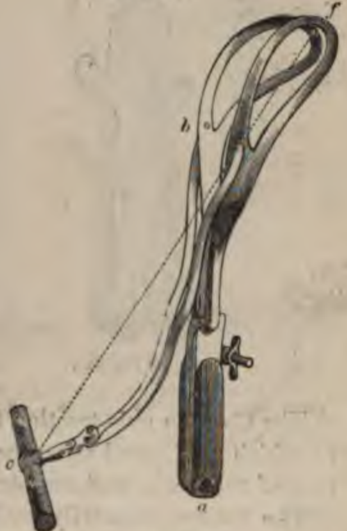
The English instrument most esteemed is that of Simpson. The cephalic portion of the blade is 6¼ inches long, the fenestra 1¼ inches wide. The blades are 1 inch apart at their tips when closed, and 3 inches at their widest portion; the object of this width is to lessen the compressing power. The pelvic curve is not great, to allow rotation of the head. Between the cephalic portion of the blade and the lock is a straight portion or shank 2⅜ inches long, bent at right angles at the handle. The purpose of this knee so formed is to bring the lock without the maternal genitalia: the operator's finger may be also placed above the lock to aid in traction. Two projecting rests below the lock afford an additional security of grasp.[1] Simpson's forceps is a favorite with many Americans. Lusk has habitually used and recommended the original model of this instrument.[2] For axis traction Simpson has modified Tarnier's instrument: the general form is that just described; the traction-rods are fixed upon the instrument.

FIG. 16.



Simpson's Forceps.

FIG. 17.



Simpson's Axis-traction Forceps: *a*, *b*, traction handle; *c*, *f*, line of traction.

The Naegele forceps is most used in Germany, although Simpson's is frequently employed, especially in Braun's modification. The Naegele forceps resembles Smellie's, but is noteworthy for its lock, which is that of Brünninghausen: this consists of a pivot upon which is a flat button fitting into a notch upon the opposite blade. This forceps is at present made entirely of metal, with carefully rounded edges and without crevices in which septic matter might accumulate.

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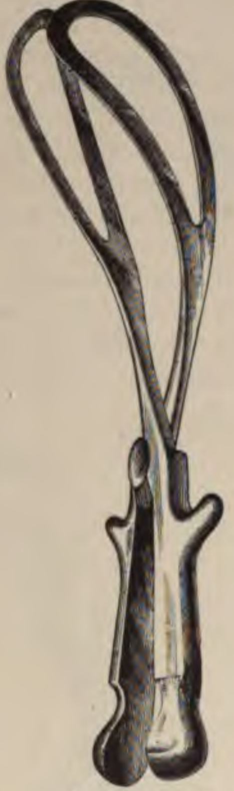
[1] Playfair: *The Science of Midwifery*, 1885.

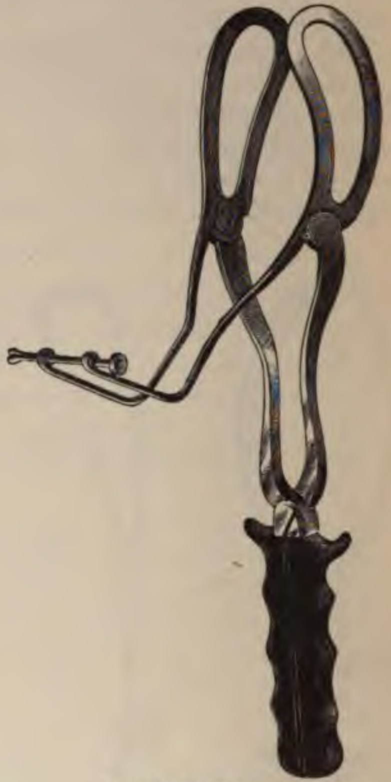
[2] *Midwifery*, 1886.

FIG. 18.



Naegele's Forceps.

FIG. 19.



Breus' Axis-traction Forceps.

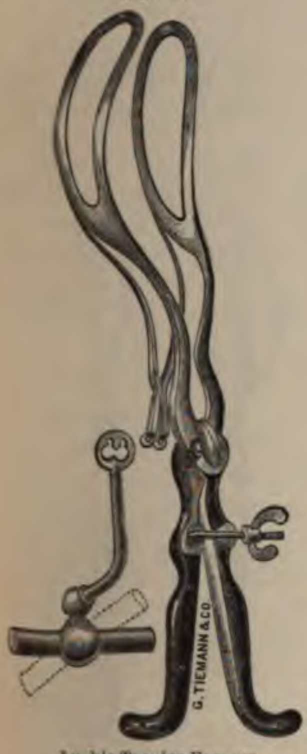
The German axis-traction forceps is that of Breus, the traction-rods of which are hinged upon the posterior extremity of the cephalic portion of the blade, and are non-detachable.

The forceps ordinarily used in France is modelled upon Levret's, as exemplified in Pajot's and Stoltz's. For axis traction Tarnier's well-known instrument has not only been adopted by the French, but has been extensively used by others. As most recently constructed it is without the perineal curve. This instrument is known to Americans through Lusk's modification.

Other nations adopt the model advised by the school of obstetrics whose teachings are followed, and these are usually the instruments described. Parallel forceps have been principally constructed and recommended by the Lyons School and by Lazarewitch:[1] they have not found wide adoption.

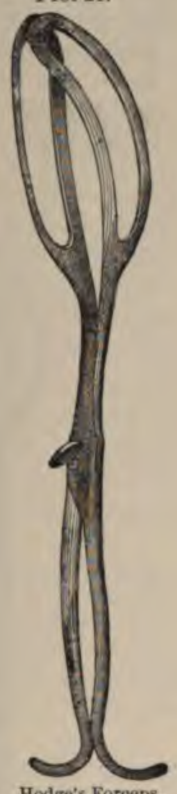
Hodge's, Wallace's, Elliott's, and Smith's may be taken as types of American forceps. Hodge's instrument was constructed upon the belief that the obstetrician will do best with a forceps suitable for application at any portion of the pelvis, and to which he is accustomed.[2] The possessor of a good long forceps absolutely needs no other—an opinion shared by the majority of obstetricians. Hodge based his forceps upon Baudelocque's model, added Siebold's lock, and made the instrument light and graceful. The cephalic portion of the blades is carefully adapted for application to the child's head and at the brim of the pelvis. The blade is 16 inches long; the cephalic portion 6 inches in length, with fenestra 1½ inches wide: the shanks are 4 inches long. This forceps should weigh 17 ounces.

FIG. 20.



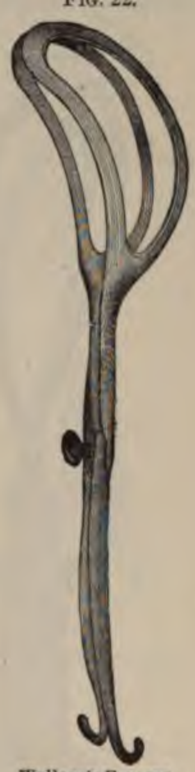
Lusk's Tarnier Forceps.

FIG. 21.



Hodge's Forceps.

FIG. 22.



Wallace's Forceps.

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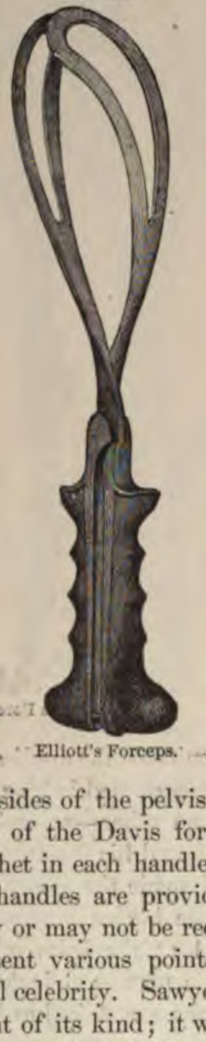
[1] *Proceedings Ninth International Medical Congress*, Washington, 1887.

[2] *System of Obstetrics.*

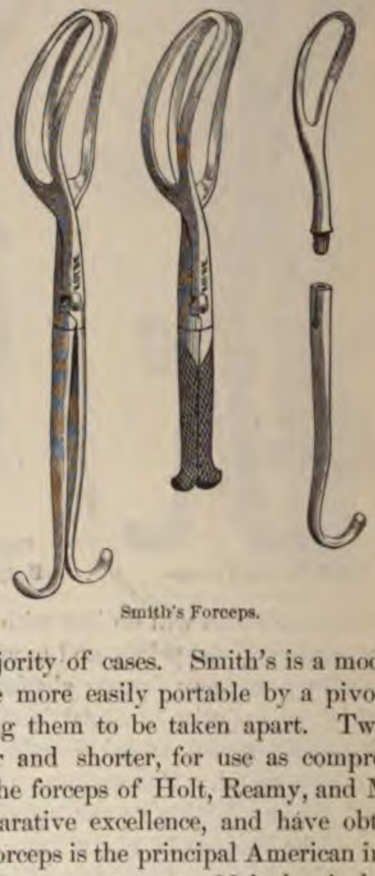
The Wallace forceps combines the blades of Davis of London, which were the result of very minute adaptation to the child's head, and the handles of Hodge's forceps, with a lesser curve. It is 1 inch shorter than Hodge's forceps, with more open fenestræ and shorter shanks, giving greater compressing power: its lock is the same and its weight greater. Elliott's forceps is a modification of Simpson's, 15 inches long, and differs from Simpson's forceps chiefly in the omission of the projecting shoulders upon the shanks; it possesses also a pin fitted between the ends of the handles, to prevent undue compression of the head. It is intended for application to the sides of the pelvis in the majority of cases. Smith's is a modification of the Davis forceps, made more easily portable by a pivot and ratchet in each handle, permitting them to be taken apart. Two sets of handles are provided, longer and shorter, for use as compression may or may not be required. The forceps of Holt, Reamy, and Miller present various points of comparative excellence, and have obtained local celebrity. Sawyer's short forceps is the principal American instrument of its kind; it weighs but 5 ounces, measures 9¾ inches in length, and combines the blades of Davis, the shanks of Hodge, and Smellie's lock, with hard-rubber plates upon the handles.

FIG. 23.



Elliott's Forceps.

FIG. 24.



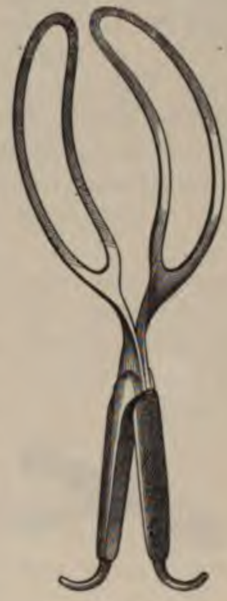
Smith's Forceps.

Among the various applications of the principle of axis traction, the effort to substitute flexible tractors for the ordinary metal rods has proven fairly successful. Sänger has passed flexible bands through the posterior extremities of the fenestræ, and thence through a rubber ring encircling the forceps at the handles: these bands terminate upon a transverse handle below the lock. Depaul has devised an apparatus of cloth consisting of a band encircling the head, to which are attached four tractors; the band is adjusted upon the head by a long flexible rod and is then laced firmly. This device he has styled the *sériceps*.

Poullet has overcome what he considers defects in Tarnier's forceps by perforating the cephalic portion of the blades at the junction of the posterior two-thirds with the anterior third, passing traction cords through these apertures, which terminate in a handle resembling Tarnier's. It is evident that the simplicity of this device, and the ease with which it may be added to any long forceps with which an obstetrician may be familiar, commend it for more extensive use. It is claimed that traction by this means leaves the head free to mould itself to the pelvis and to follow in the best possible manner the pelvic axis.[1]

Steavenson of London, at the meeting of the British Medical Association, August, 1888, presented a forceps resembling Simpson's very closely. As an accompaniment he had devised a blunt-hook tractor which he hooked over the lock, thus making downward traction in the pelvic axis.[2]

FIG. 25.



Sawyer's Forceps.

It is evident that the ingenuity of the obstetrician must solve problems in traction with the forceps as they arise. In common with other instruments used in medicine, that device is best which is simplest and which is most perfectly under the control of the skill and intelligence of the operator.

Good forceps, whether long or short, should be made of well-tempered steel, nickel-plated, with rounded edges and with smooth hard-rubber or metal handles; a corrugated handle is objectionable as affording lodgment for septic matter. The pelvic and cephalic curves should be those of one of the approved models described. The instrument should be sufficiently heavy to be firm; the lock should be easily adjustable and secure; many operators prefer a lock which permits easy separation of the blades and a slight rocking motion.

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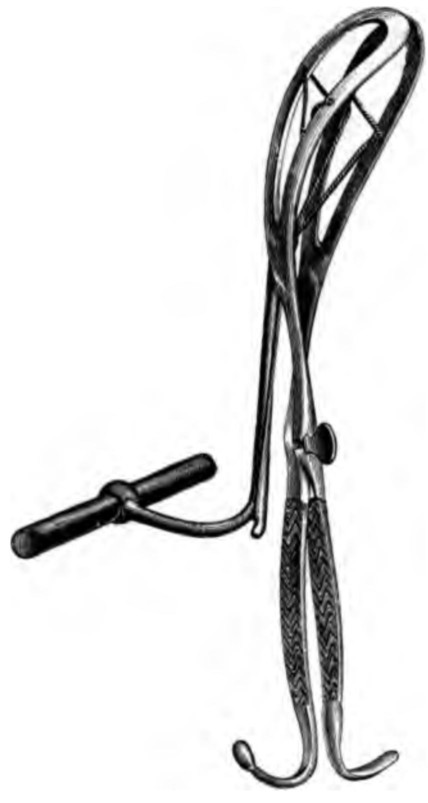
[1] Poullet: Thèse, *Des Diverses Espèces de Forceps*, Lyon, 1883.

[2] The writer is indebted to Professor Parvin, who has recently brought it from Europe, for permission to examine and represent this instrument.

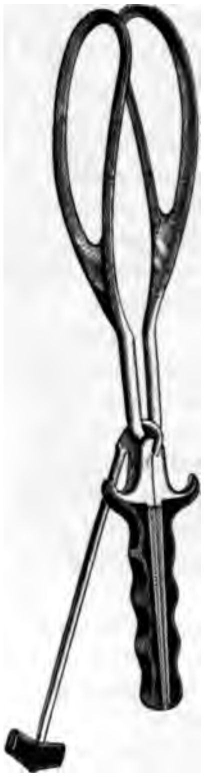
THE FUNCTION OF THE FORCEPS.—The forceps is primarily a tractor, a reinforcement of *vis à tergo* by *vis à fronte*. Its functions as a compressor, rotator, and lever are secondary and incidental, as is its office in preserving the perineum from rupture.

FIG. 26.



Poullet's Axis-traction Forceps.

FIG. 27.



Steavenson's Device for Axis Traction.

INDICATIONS FOR THE USE OF THE FORCEPS.—Failure or delay in the action of the mother's expulsive forces is the most frequent indication for the forceps. In keeping with its conservative function, it may be said that any cause necessitating prompt delivery, when certain conditions are fulfilled, calls for the forceps in the interests of mother and child. Failure or delay in the expulsion of the child may be caused by imperfect maternal nervous and muscular development; exhaustion from long-continued efforts necessitated by mechanical obstacles to delivery or caused by chronic anæmia and wasting diseases; loss of blood, as in placenta prævia, causes failure of expulsion and calls for the forceps.

Mechanical obstacles to delivery must be relative and not absolute, however, to justify the use of forceps. The form of mechanical obstruction most clearly an indication is rigidity of the maternal tissues. This, by gradually exhausting the peristalsis of the genital tract, results in the delay of the head, pressure followed by engorgement of both maternal and fœtal tissues, with impending necrosis, and, when tissue so engorged becomes infected, in general septic infection.

CONDITIONS JUSTIFYING THE EMPLOYMENT OF FORCEPS.—It is generally held that a cephalic presentation of the fœtus is a necessity. Tarnier, however, rejects the blunt-hook in breech presentations when the hook cannot reach the feet, and applies his axis-traction forceps to the breech. The instrument is absolutely contraindicated in other presentations.

The membranes should be ruptured, and also retracted over the head, as traction upon the membranes will tear away the placenta. The external os uteri should be so far dilated and retracted that its edge can be scarcely reached by the examining finger.[1] It is also said that the os must be as large as the palm, or at least larger than an American silver dollar. It is evident that the actual size of the os uteri is not the only essential, but that the degree of elasticity of the os and cervix and the size of the head are important factors in justifying the application of forceps. There must be no mechanical obstacle to delivery in the maternal parts not surmountable without the exercise of great force.

On the side of the fœtus hydrocephalus forbids the forceps. The head of the fœtus and the birth-canal of the mother must be proportionate in size. The head must have moulded itself to the pelvic canal; in other words, must engage. As a rule, the smaller fontanelle must be directed anteriorly. In point of time Pajot believes that when the head has remained stationary for two hours upon the pelvic floor instrumental delivery is indicated. Here, again, judgment must be exercised. It is not the exact length of time, but the degree of compression to which soft tissues are subjected and the effect produced, which justify interference. The head of the fœtus must be not only of proportionate size, but of normal consistence; the head of a macerated fœtus or the perforated head after craniotomy should not be delivered with forceps.[2]

The application of the forceps to save the time and promote the convenience of the obstetrician is not to be commended. The conservative function of the instrument is to be clearly kept in mind, and its employment strictly limited to the fulfilment of that function.

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[1] Schroeder: *Lehrbuch der Geburtshülfe*, 1886.

[2] *Ibid.: loc. cit.*

THE APPLICATION OF THE FORCEPS.—It is important that an accurate diagnosis of the presentation and its position should be made before proceeding to the application of the forceps. In addition to abdominal palpation, a vaginal examination should be made just before the introduction of the instrument, and this should be unusually thorough. Two fingers, or enough of the hand to determine the position, should be employed. Forceps cases are prolonged, and the patient is usually subjected to more frequent examination than in normal labor. Especial attention should therefore be given to the preservation of an aseptic condition of the vagina and cervix. A hot vaginal douche of dilute bichloride solution, 1 : 4000, should be employed before the vaginal examination made for diagnosis. The hands and forearms of the operator should have been scrubbed with soap and hot water, rinsed in clean water, and washed in bichloride solution, 1 : 1000. The forceps should be cleansed with soap and hot water and with a 5 per cent. solution of carbolic acid. To lubricate the blades glycerin and carbolic acid, 3 per cent., or carbolized vaseline, 5 per cent., should be used, the blade being anointed upon the surface next to the maternal tissues only.

In common with the majority of European operators, Americans prefer to place the patient upon the back: the English choose the position on the left side. It is well to inform those of the patient's family attending her of the intended use of the forceps; it is generally sufficient to remark to the patient that help is about to be rendered in a safe and speedy way, her part in the ending of her sufferings being the necessary change of position and the inhalation of an anæsthetic. Ether is commonly used in America, although chloroform is employed in other countries with the greatest advantage. In women unusually self-possessed, in whom delivery will be comparatively easy, an anæsthetic may be dispensed with; but in the majority of forceps cases it should be used, and its administration should be entrusted to a reliable physician whenever possible. In hospitals an operating-table for the delivery of difficult cases may be used to advantage. In private practice the patient, when anæsthetized, should be placed comfortably across a bed, which should not be too low, her hips brought well over the edge, the legs being wrapped in blankets and held by assistants; when help is limited they may be placed on chairs. The obstetrician should sit or stand directly before the patient, taking care that her pelvis is directly opposite him, and that it remains as much as possible in this position.

Having assured himself that the rectum and bladder are empty, the operator should proceed to introduce and lock the instrument. For practical purposes the blades of the forceps are known as left and right, as they are introduced upon the left and right sides of the mother. Hence Pajot's familiar rule—the left blade to be taken in the operator's left hand, and introduced on the left side of the mother's pelvis. Enough of the right hand, preferably the four fingers, should be inserted in the vagina and cervix and passed between the head and the cervix uteri to effectually guide the entering blade. Grasping the left blade near the lock with the left hand, the operator allows it to glide along the palmar surface of the right hand, depressing the handle as it proceeds. Failure to enter easily calls for readjustment of the right hand, preceded by the withdrawal of the blade. When the left blade has adjusted itself to the head, as it should do easily, it may be lowered, and the hand of an assistant placed upon the handle to prevent its expulsion during a uterine contraction. The left hand should then be inserted upon the mother's right side, and the right blade similarly introduced, above the left. If the forceps grasps the head in its biparietal diameter, the blades will easily lock. If this is not the case, the blades may be slightly withdrawn or advanced, or their position slightly altered, when a second effort to lock should be made. If the forceps will not lock without considerable force, the obstetrician has reason to fear that the presentation is not occipito-anterior. In this event the instrument should be withdrawn, and the obstetrician should take advantage of the patient's anæsthetized condition to re-examine her; and should the presentation not be occipito-anterior, he may rectify it by manipulation or decide upon further procedures.

The application of the forceps calls for gentleness and due deliberation, and the danger of including maternal tissue in its grasp should be kept in mind. It has been urged that this danger is lessened by allowing the mother to remain conscious, as her complaint of pain on traction would indicate violence done to her tissues. As she will naturally experience increased pain when the head advances, the operator should not rely upon this indication of improper adjustment, but should satisfy himself of the proper performance of his own manipulation.

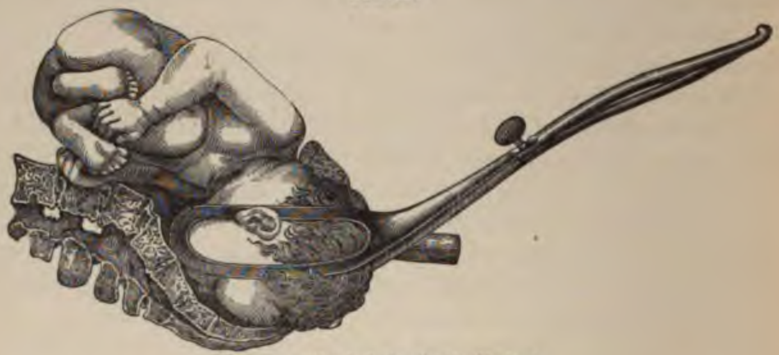
Before discussing traction with the forceps it is expedient to classify to some extent the various presentations and pelvic conditions which justify its use.

Forceps cases naturally divide themselves into those in which the mother's birth-canal and the fœtal head are proportionate in size, and those in which they are disproportionate. From the side of the fœtus, cases requiring the forceps may be divided into those in which descent and rotation of the presenting part occur normally, and those in which they do not occur. It is evident that the full discussion of the second topic will open the field of choice between the forceps, version, craniotomy, and Cæsarean section.

THE FORCEPS WHEN THE HEAD AND THE BIRTH-CANAL ARE PROPORTIONATE IN SIZE.

IN OCCIPITO-ANTERIOR POSITIONS, DESCENT AND ROTATION HAVING OCCURRED.—This represents the most simple case demanding instrumental aid. Recalling the mechanism of normal labor, it will be remembered that the fœtal head is expelled from the vagina by the contraction of the abdominal muscles of the mother, aided by the comparatively feeble force of the partially emptied uterus. The trunk of the fœtal body would remain in the genital canal were it not for the expulsive action of the abdominal muscles.[1] It will be readily seen that a patient whose abdominal muscles are poorly developed will fail to expel the fœtus from the genital canal, especially if the perineum be rigid and the peristalsis of the genital tract be exhausted. These are the cases met with among the well-to-do when forceps must be used to terminate a labor otherwise normal. Traction in such cases consists in bringing the occiput well under the pubes, maintaining flexion and allowing extension to occur slowly and with as little danger to the perineum as possible.

FIG 28.



Forceps at the Inferior Strait (Hodge).

For the preservation of the perineum the simple procedure of incising laterally the attenuated tissues at the lower third of the vulvar arc is often of considerable practical value. Episiotomy has been considered by some American writers on obstetrics as a fit procedure for amateurs, but in the hands of skilled obstetricians in the Vienna General Hospital the writer has frequently seen perinea saved by this simple expedient; and the teaching of these operators is that it is a resource of undoubted value. Traction in these cases will be first downward, then horizontal, until the occiput projects from the vulva, when the face may be lifted cautiously over the perineum. Traction should be intermittent, and between tractions the grasp of the forceps upon the head should be relaxed to prevent compression. Tractions should be synchronous with uterine and abdominal muscular contractions: unless these are too infrequent, it is well to have an assistant standing beside the patient steadying the uterus and pelvis and exciting the abdominal muscles and uterus to action by moderate compression or friction.

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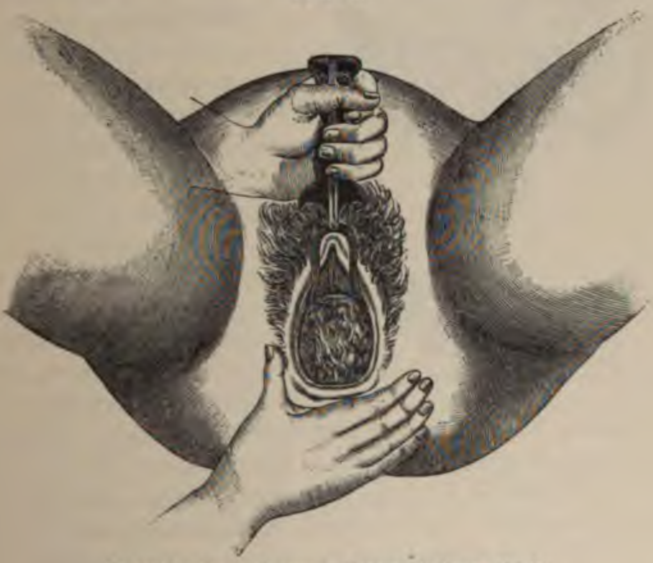
[1] Schroeder: *op. cit.*

In cases where the head has not reached the perineum, but descent and rotation are nearly completed, many prefer to bring the head well down upon the perineum by forceps, thus rousing the expulsive forces through reflex nervous stimulus from the distended tissues, and then remove the forceps, allowing the expulsion of the head to follow. If the abdominal muscles are not deficient or exhausted, there can be no objection to this practice; but unless the obstetrician can expect that the final effort of parturition will be a vigorous one, he will do well to complete the labor instrumentally. The force requisite for delivery under these circumstances is a very moderate one; and the exceptional functions of the forceps, compression, leverage, and rotation, are not required. The operator may stand at the patient's right side during the emergence of the head, grasping the forceps with the left hand, while his right supports the perineum, or the same manipulation may be performed while standing before the patient. It is in these cases of muscular inertia that the short forceps is preferred by many obstetricians.

FIG. 29.

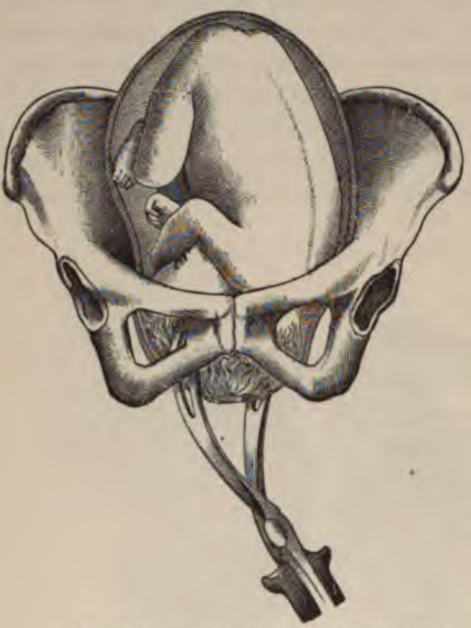


Protecting the Perineum in Forceps Delivery (Lusk).

FORCEPS IN OCCIPITAL PRESENTATIONS, WHEN ANTERIOR ROTATION FAILS.—In normal labor anterior rotation is effected by the inclined planes of the pelvis, the resistance of the pelvic floor, and the expulsive forces of the uterus and abdominal muscles. When, through the deficiency of any of these factors, rotation fails, labor is delayed, and the interests of mother and child may demand instrumental delivery. The question then arises, Shall the forceps be applied along the sides of the pelvis and in its axis, grasping the head as best it may, or, shall the instrument be fitted to the head, being introduced obliquely in the pelvis?

The experience of many competent obstetricians has proven that the forceps may be applied along the sides of the pelvis and a living child delivered without damage to fœtus or mother, provided the grasp of the instrument be relaxed when tractions are not in force, and the head be allowed to mould itself and rotate spontaneously. It is also true, however, that in cases where the head and the pelvis are of normal proportions the more skilful procedure is the oblique application of the forceps.

Fig. 30.



The Forceps in Defective Occipital Rotation.

It is well to try simple means of effecting rotation before having recourse to instrumental delivery. The patient may be placed upon that side which is occupied by the vertex; any malposition of the uterus may be corrected: the hand introduced into the vagina is often an efficient means of effecting rotation. Any measure tending to give the mother a brief rest, thus increasing the expulsive forces, may be employed; a stimulant may be given, but in moderation. Should it be decided to apply forceps, and the position having been accurately diagnosticated, the instrument should be introduced in the oblique diameter of the pelvis opposite to that occupied by the head: Pinard's direction is to apply the blades at the extremities of the empty oblique diameter; and this diameter will be that in which the biparietal diameter of the head will generally be found. Exception may be made to the rule to insert the left blade first: Tarnier countenances the introduction of the blade which comes anteriorly first, whether it be right or left. No rule, however, is invariable for abnormal cases, and the peculiarities of the individual case and the skill of the operator will decide the mode of application.

Especial care should be observed in introducing forceps obliquely that the maternal tissues are well guarded from its grasp. The function of the forceps as a compressor is to be exercised in these cases, but with decided moderation. Traction is made as in normal rotation, downward, horizontally, and upward. If care be taken to allow the head to mould itself by relaxing the grasp between tractions, injurious compression will be avoided and the head will gradually assume a normal position. Rotating or twisting motions with the forceps should be avoided, and pendulum or oscillatory tractions are contraindicated. The desired rotation will be best accomplished by the natural mechanism, the forceps playing the part of a reinforcement of the expellent forces. The forceps should rotate with the head, rather than the head be forcibly rotated by the forceps.

IN OCCIPITO-POSTERIOR POSITIONS.—Should the occiput rotate posteriorly, it would be the part of wisdom not to attempt its forcible rotation anteriorly by forceps. The effort of the obstetrician should be to imitate nature's delivery in these cases. A watchful delay in adopting instrumental interference is wisest. A healthy mother rarely fails to rotate the head anteriorly, and signs of exhaustion on the part of the mother and failure in the action of the fœtal heart must be present before hope of spontaneous timely rotation is to be abandoned. When these indications are present delay should cease. The patient should be anæsthetized and the forceps applied to the sides of the child's head. Traction should then be made horizontally until the forehead appears beneath the pubes. The grasp of the forceps may then be relaxed to advantage: the handles should be lowered and a new grasp taken. The object of this manœuvre is to perform flexion over the perineum as the head emerges. The operator then clears the forehead from beneath the pubes, and flexes the head gradually until the occiput has passed the perineum and the head is born. Laceration of the perineum generally occurs in these cases, but the injury should not be severe and should be immediately repaired.

There are those who consider the application of the forceps in occipito-posterior positions as a doubtful expedient, and Penrose[1] describes a condition in which the fœtal body is so firmly grasped by the uterus, the child's abdomen and thorax being anterior, that rotation of the occiput is impossible, because the trunk cannot rotate; he would resort to forcible rotation or craniotomy in occipito-posterior positions. The majority of obstetric authorities, however, favor the judicious application of forceps in these cases.

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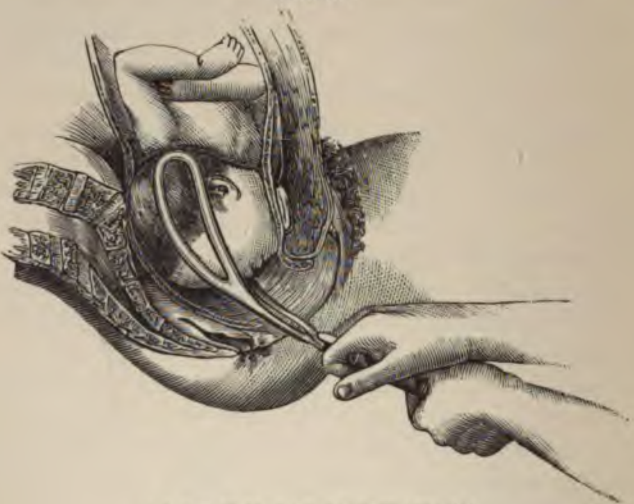
[1] *Lectures at University of Pennsylvania.*

In regard to the tolerance of rotation on the part of the fœtus, the rule that rotation of the head beyond a quarter of a circle is fatal to the child through injury to the spinal cord has been disproven by Tarnier, who has shown that torsion upon the fœtal head is not exerted upon the occipito-atloid ligament, but is distributed along the cervical spine: rotation beyond forty-five degrees often occurs in spontaneous delivery. Cazeaux and Ribemont confirm Tarnier's conclusions. Ribemont experimented upon frozen specimens, and observed that torsion was distributed along the cervical and dorsal spine, while the cord remained in the centre of the spinal canal and rotated upon its axis.[1]

In Face Presentations.—In face presentations the application of the forceps should be delayed as long as possible. When rotation occurs spontaneously, the blades may be applied to the sides of the head, care being exercised to grasp the head sufficiently far posteriorly to ensure a firm hold. Extension should then be maintained, and the mechanism of spontaneous delivery in this presentation should be imitated.

When rotation does not occur the utmost caution should be observed in using the forceps. All simple means should be employed to favor spontaneous rotation. A patient and thorough effort, with the parturient anæsthetized, should be made to rotate the chin anteriorly by the hand: it occasionally happens that when the head is not impacted the presentation may be converted into an occipital in the course of this manipulation. When the head fails to descend the forceps should not be applied

Fig. 31.



Forceps in Face Presentation (Parvin).

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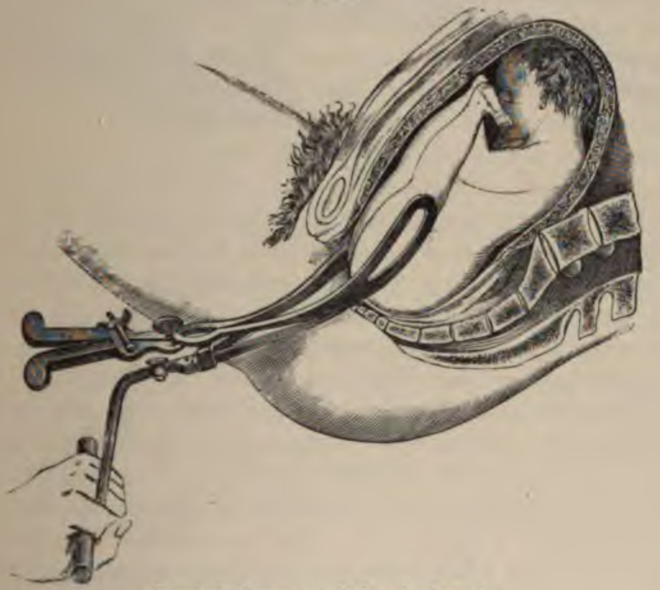
[1] Pinard: "Forceps," *Dict. Encyc. des Sciences méd.*, tome troisième, Paris, 1877.

when version is possible.[1] Carl Braun strongly condemns the high application of forceps in face presentations. When descent has occurred, but rotation is not properly accomplished, Schroeder advises the application of the forceps, when absolutely necessary, in such a manner that the concavity of the pelvic curve shall be directed toward that side of the pelvis to which the chin points: when the chin is toward the right side of the pelvis, the forceps should be applied in the right oblique diameter. The instrument should very rarely be applied when the face extends transversely across the pelvis: in favorable cases Carl Braun admits tentative traction, in the hope that rotation will occur; the forceps is to be removed as soon as the chin rotates, and reapplied if needed.

When the chin rotates into the hollow of the sacrum, the rule that forceps delivery is impossible and not to be attempted is very rarely to be disregarded. It is occasionally possible to imitate the delivery of an occipito-posterior position and draw the chin downward by narrow, straight forceps: Taylor's straight forceps has proven an efficient instrument in his hands in two such cases.[2] Others have rarely succeeded in this procedure, and it is most exceptional.

The Forceps applied to the Breech.—The danger of injuring the abdominal viscera and genitalia of the fœtus has prevented the application of the forceps to the breech. With the introduction of his

Fig. 32.



Tarnier's Forceps applied to the Breech.

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[1] Schroeder: *op. cit.*

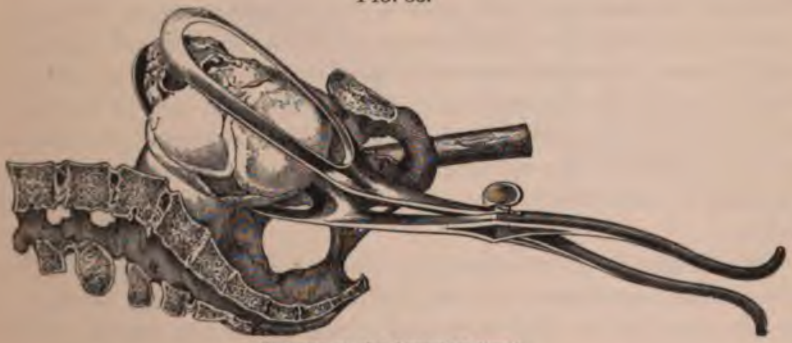
[2] *N. Y. Medical Journal*, Nov., 1869.

axis-traction forceps Tarnier has demonstrated the possibility of delivering the fœtus safely by applying the blades in the iliac or trochanteric diameter of the pelvis. He has also applied his forceps in the sacro-pubic diameter, the genitalia occupying the fenestra of the blade, and extracted a fœtus without injury. When the fœtus lives, the instrument should grasp its pelvis in a transverse diameter. When the death of the fœtus has occurred, the only precaution necessary is the obtaining of a secure hold with the forceps. Great gentleness in making traction is requisite, and in delivering a living child it is well to take every precaution against undue compression.

THE HIGH APPLICATION OF THE FORCEPS.—By this term we understand the application of the forceps to the presenting part situated at the superior strait of the pelvis. It is evident that this is a procedure attended by increased dangers to mother and child, and hence the conditions which justify the performance of the operation should be clearly determined. Failure of the head in these cases to accommodate itself to the pelvic canal is the cause of delay in labor, which results in gradual exhaustion of the expellent forces through ineffectual efforts to accomplish descent. This absence of accommodation may be caused by the malposition of a normal head through dislocation of the uterus, or by disproportion in the size of the head and that of the birth-canal. In the first instance the abnormal elasticity of the tissues following repeated parturition may result in anteversion of the pregnant uterus and the delay of the head in one of the iliac fossæ: at labor the weakened lower uterine segment may not possess sufficient firmness to resist excessive dilatation, and malposition of the head, with threatened rupture of the uterus, may result. In these cases the uterus should be replaced, and maintained in such a position that the direction of its axis favors descent. Efforts should be made by manipulation and the employment of the force of gravity to dislodge the head and favor its engagement. This will be best accomplished by anæsthetizing the patient and endeavoring by external manipulation to correct the position of the head. If success follows, pressure downward and slightly backward should be made above the pubes, and maintained for a sufficient time to give the head an opportunity to mould itself to the superior strait and to commence descent. If the head be dislodged and flexed, and pressure be made in the axis of the superior strait, the danger of injuring the lower uterine segment will be inconsiderable. Should engagement and beginning descent result, it is a fair conclusion that the head and the birth-canal at the superior strait are proportionate in size, and that the application of the forceps to the head as it has engaged at the superior strait will be successful and a conservative measure to both mother and child. These measures occasionally result in the resumption of the forces of normal labor and the spontaneous expulsion of the child. Should this occur, the administration of a stimulant addressed to the nervous system will often facilitate delivery.

Should the high application of the forceps be indicated, the choice of an instrument is important. Operators in maternities or who have extensive consulting practice are accustomed to the use of forceps especially constructed for axis traction. The average practitioner may follow his profession for years without resorting to the high application of the forceps, and an axis-traction instrument may not be included in his armamentarium. The advantages of axis-traction instruments in skilful hands are undoubted. If, however, the practitioner is possessed of that combination of judgment, practical aptitude, and self-control which is so important to an obstetrician, he will find his long forceps sufficient for success. The American models of long forceps previously described are well adapted for axis traction, and have repeatedly proved competent for the exigencies of these cases. The assistance of a professional friend or intelligent nurse is especially desirable. Before applying the forceps the obstetrician should ascertain accurately by vaginal examination the position of the head. Antiseptic precautions, as already indicated, should be rigorously observed.

FIG. 33.



Forceps at the Superior Strait.

The head will generally be found engaged in an oblique diameter of the pelvis. The forceps should ordinarily be applied to the head, in accordance with the rules quoted. If, however, the obstetrician has been accustomed to apply his instrument to the sides of the pelvis, especially if he uses habitually Simpson's forceps or a modification of them, he will do well to follow his usual practice. Should the head, on vaginal examination, be found to lie in the transverse diameter of the pelvis, the mode of application of the forceps is questionable. The French admit rotation of the occiput forward with the forceps; the Germans do not apply the forceps until rotation has occurred; the English apply forceps to the sides of the pelvis—a procedure which is followed by the majority of Americans. This results, in the greater number of cases, in the oblique adaptation of the blades to the head —the anterior near the coronal suture, the posterior over the parietal eminence.[1] If the forceps be applied to the head in an oblique diameter of the pelvis, the blades will lock with ease. If the head be grasped by the forceps at the sides of the pelvis, the blades will lock with difficulty. Sufficient compression should be made to ensure a firm grasp, and as delivery proceeds the blades will become properly applied.

Traction should be performed in the axis of the pelvis; and the determination of this axis has been attempted by the application of the principles of mathematics in the study of the bony pelvis. However valuable such investigations may be to the anatomist, for the practical obstetrician there is need of a knowledge of the axis and constitution of the birth-canal in the living mother. The studies of Braune, Schroeder, Bandl, Hofmeier and Benckiser, Pinard, Boissard, and Hart and Barbour have led modern obstetricians to regard the birth-canal as a cylinder whose axis extends at first downward and backward until it meets the sacral segment of the pelvic floor, which by the part that it plays in the dynamics of parturition turns the axis of the birth-canal to a direction upward and forward. The relation of the inferior uterine segment to the cervix, the pubic arch, and the superior uterine segment is important in the effort to avoid injury to the maternal tissues.

By reference to the accompanying illustration by Schroeder,[2] which is a schematic representation of the birth-canal based on his anatomical studies, it will be seen that the genital tract at parturition may be divided into a superior expulsive portion, composed of the muscular segment of the uterus, and an inferior elastic tract, comprising the inferior uterine segment, the cervix, and vagina. The axis of the expulsive portion extends downward and backward. The axis of the elastic division of the genital tract continues downward and backward, impinging upon the coccyx and sacral segment of the pelvic floor, whence it is deflected almost at right angles upward and forward. The forceps is applied to supplement the action of the expulsive portion; it must conduct the fœtus through the elastic division of the genital tract. As the presenting part engages at the superior strait, it is enclosed by the lower uterine segment, and often by a portion of the cervix. These tissues will be liable to injury from undue compression or from the projection anteriorly of the tips of the blades. Axis traction, then, should be made downward and backward until the head impinges upon the coccyx and the pelvic floor, when the direction should be upward and forward to lift the head over the perineum. The blades should be so applied to the head that they will not project beyond its circumference and injure the maternal tissues.

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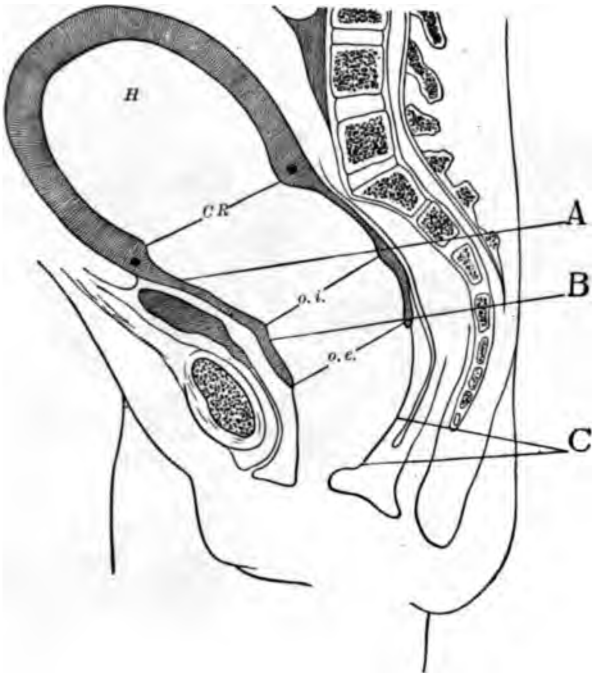
[1] Lusk: *op. cit.*

[2] *Lehrbuch der Geburtshülfe*, 1886, p. 153.

If the elasticity of the lower portion of the genital tract be deficient, the operator may be called upon to introduce the forceps through the partially-dilated cervix and inferior uterine segment. This complication adds very considerably to the dangers of delivery, and efforts to dilate the cervix by the hand or Barnes' dilators should be made before introducing the forceps. Rupture of the inferior uterine segment may occur, following long-continued pressure by the head and violent efforts at delivery.

FIG. 34.[1]



The Birth-Canal at the End of the Stage of Dilatation (schematic; Schroeder): *H*, superior expulsive muscular segment; *C R*, contraction-ring; *o. i.*, os internum; *o. e.*, os externum; *A*, the inferior elastic uterine segment; *B*, the cervix; *C*, the pelvic floor.

To effect axis traction with the ordinary long forceps the handles should be carried as far posteriorly as is deemed prudent. The operator's stronger hand may then be placed upon the handles at the lock as the fulcrum, while the other hand at the extremity of the handles uses the forceps as a lever. Dr. Albert H. Smith was an advocate of this mode of operating, in which he was expert. Pajot by a similar manœuvre makes the forceps a lever of the first or of the third order at pleasure. To perform this manipulation well requires strength and dexterity. Traction without it is fairly safe, and although force is wasted by pressure against the symphysis pubis, still children are not infrequently so delivered without great damage to the mother.

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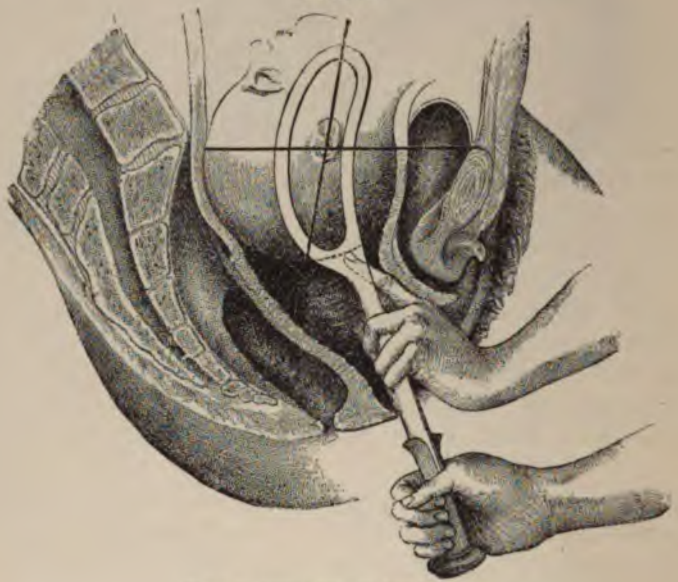
[1] Schroeder: *Lehrbuch der Geburtshülfe*, 1886, p. 153, Fig. 51.

Tractions should be gradual, direct, and, during their intermittence, the blades should be slightly separated. Rotation will gradually occur, and will be completed when the pelvic floor is reached. While the forceps remains in apposition to the head during traction many prefer to partially unlock the blades between tractions, thus virtually making a new application with each step of rotation. Smellie's (Simpson) lock and Naegele's are especially well adapted for this purpose. It is very desirable that an assistant steady the uterus during tractions, maintaining its axis in the normal direction and stimulating it to contraction by massage.

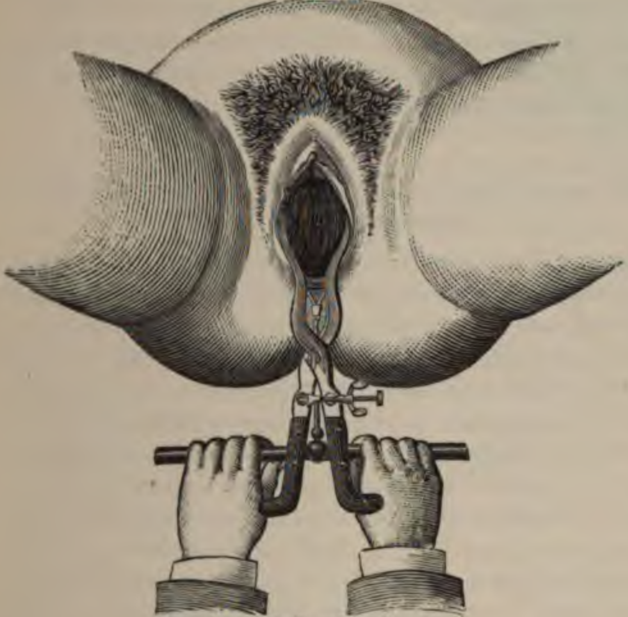
FIG. 35.



Smith's Axis Traction by Leverage.

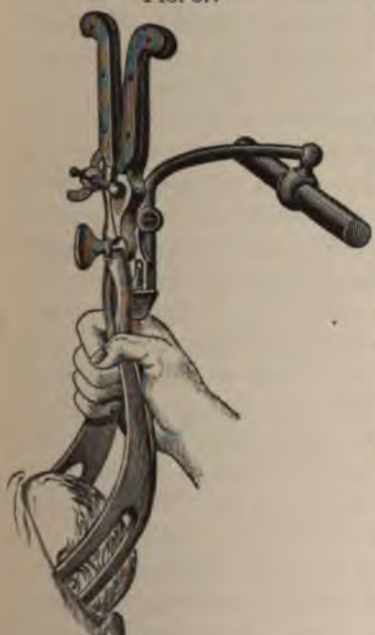
Poullet's simple expedient of passing traction cords through holes made in the cephalic portion of the blades of the ordinary long forceps, or Sänger's similar device, by either of which downward and backward traction is made, with the head free to rotate, is to be commended. Lusk's modification of Tarnier's forceps is, however, the best instrument available in America for this purpose. The traction-rod is laid upon the handle, and the blades are introduced in the ordinary manner. The compressing screw is occasionally allowed to remain unused, and should be employed with caution. Traction is made with the traction-rods until the head reaches the floor of the

FIG. 36.



Traction with Tarnier's Forceps.

FIG. 37.



Delivery by Tarnier's Forceps at the Perineum.

pelvis, when the traction rods are grasped with the handles and both are raised in guarding the perineum.

Tarnier's instrument has been extensively used in France and America, and, as modified by Simpson, in England. Its merits have found recognition in Germany, and at a recent meeting of the German Gynecological Society, Bumm and Sänger expressed their decided preference for this forceps.[1] While downward traction is effected by the rods, the handles afford an index of the position of the head, and should be allowed to rotate freely as the head advances. Tarnier has abandoned the perineal curve, which Lusk retains.

In the cases under consideration, in which the head and birth-canal are proportionate in size, there is no occasion for the use of the forceps as a lever, or directly as a rotator, or as a compressor, further than in securing a firm grasp. The proportionate size of the head and birth-canal having been ascertained, the primary function of the forceps, traction, is all which is desired in supplementing, in a conservative manner, the expulsive forces of the mother.

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[1] *Münchener med. Wochenschrift*, No. 25, 1888.

THE FORCEPS WHEN THE HEAD AND BIRTH-CANAL ARE DISPROPORTIONATE IN SIZE.

WHEN THE FŒTUS IS ABNORMALLY LARGE.—The explanation of the factors potent in determining fœtal sex and development has, in common with other obstetric hypotheses, undergone recent modification. Schroeder and Balzer have found a progressive increase in the size of the head after the third birth. Schroeder observed that the head of a first-born is susceptible to much greater moulding than the heads of children born subsequently. The belief that the individual more pronounced in type and development gives his sex to the fœtus is reasonable, and awaits disproval. An extensive statistical and literary review of the influences determining fœtal development by La Torre[1] results in the conclusion that the degree of fœtal development depends largely upon the health of the father: if he be healthy, the size of his head and shoulders and his stature decide the corresponding peculiarities of the fœtus. The weight, stature, and health of the mother exercise a comparatively slight influence upon the fœtus. The supposed increase in size of the products of successive conceptions has not been observed, and the fœtus of the primipara is as large as any which she bears in subsequent labors. It is easy to understand, on this assumption, the case of a fully-developed fœtus borne by a deficiently-developed mother. In cases of repeated pregnancy, with a history of a normal first labor, it will often be found that the father of the first child was, like the mother, inferior in type and development, while the subsequent conceptions occurred by a second husband whose development and type are normal. If summoned to attend one of the later labors of such a patient, the obstetrician can obviously base no prognosis on the history of the first labor, because the conditions of the second are essentially different. If these cases are seen sufficiently early, the induction of labor, as now practised under antiseptic precautions, is indicated at the eighth month, and offers a very favorable prognosis for the mother. Thus, Strauch reports 28 induced labors by the introduction of a bougie under strict antisepsis, with a maternal mortality of nil.[2] Wyder reports 306 cases of induced labor by similar methods with mortality 3.96 per cent.[3] The fœtal mortality attending induced labor, which Strauch estimates at 55 per cent., should lead the obstetrician to give the mother and her friends the choice of this procedure or Cæsarean section. The latter operation would be done in such a case upon what Gustav Braun has exemplified as the relative indication.[1] The proposal to apply forceps to a head of greater proportionate size than the maternal pelvis, although the latter be symmetrical or normal, is based upon the supposition that such compression can be made by the instrument as to reduce essentially the diameters of the fœtal head, either symmetrically or in a manner known to the operator and under his control. The practical fallacy of this hypothesis was early shown by Pétrequin,[2] Delore,[3] and Budin,[4] whose experiments show that compression of the head in one diameter is followed by an increase in another diameter. Fehling[5] and Keller[6] have observed that compression of the head equably upon all sides results in a symmetrical diminution in volume, caused by the recession of blood and cerebro-spinal fluid. This may be taken as a physiological compression, which is undoubtedly present in normal labor. It affords no proof, however, that a large head can be so lessened in its diameter by forceps that it will engage in a pelvis proportionately much smaller.

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[1] *Nouvelles Archives d'Obstétrique et de Gynécologie*, Nos. 6, 7, 8, and 9, 1888.

[2] *Archiv für Gynäkologie*, Band xxxi. Heft 3.

[3] *Ibid.*, Band xxxii. Heft 1.

Recent experiments upon the effect of compression of the fœtal skull, by Murray,[7] illustrate the results of very moderate pressure in the occipito-frontal diameter. Compensation results in these cases by the sliding of the occipital and frontal bones under the ends of the parietal bones, with vertical elongation of the skull: the transverse diameters are not enlarged by moderate pressure. Axis traction with moderate pressure, when the head had engaged transversely, would bring the axis of elongation into the pelvic axis, enabling delivery to proceed and imitating the natural phenomena of labor.

Compression made in excess of this physiological phenomenon can result only in distorting the head, injuring the brain, and wounding the maternal tissues. It is evident that the hydrocephalic head should not be grasped by forceps, because the danger that the blades will slip is very great, and rupture of the uterus has resulted from such an accident. The hydrocephalic head should be punctured by a fine trocar, and sufficient fluid removed to allow labor to terminate spontaneously, or, preferably, to enable the obstetrician to perform version.

WHEN THE FŒTUS IS ABNORMALLY SMALL.—The application of the forceps to a head inferior in size to the birth-canal is rarely indicated. The great majority of obstetricians, of all nations, agree in preferring version in this condition. Should the os but partially dilate, and ineffectual labor-pains threaten the exhaustion of the patient, it may possibly be admissible to introduce narrow-bladed forceps within the uterus, dilate the os with the head, and deliver the child.[1] But spontaneous delivery, with speedy labor, is the rule when the fœtus is abnormally small, and version is indicated when interference is justified.

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[1] *Wiener Medizinische Presse*, No. 9, 1888.

[2] *Traité d'Anatomie topographique.*

[3] *Gazette hébdom.*, 1865.

[4] *De la Tête du Fœtus au Point de Vue de l'Obstétrique.*

[5] *Arch. für Gynäkol.*, Band vi. p. 68.

[6] *Dissertation*, Erlangen, 1877.

[7] *Edinburgh Med. Journ.*, Nov., 1888, p. 417.

FORCEPS IN CONTRACTED PELVES.

Recent studies in the anatomy of the birth-canal, the perfecting of the Cæsarean operation, and antisepsis have altered very materially the beliefs of obstetricians regarding the indications for the use of the forceps in contracted pelves. But little more than ten years ago Tarnier's forceps had not been invented; the anatomical division of the uterus into expulsive and elastic segments had not been made; Sänger's operation was unknown; and antiseptics were not understood and were irrationally used. Each of these data is an important factor in determining the means to be employed in effecting delivery through a contracted pelvis.[2]

The growth of knowledge regarding these cases has limited the forceps to its original function—a tractor and a conservative instrument for mother and child. In well-appointed maternities the obstetrician will become aware of disproportion in the size of the pelvis before labor, if the patient remains for some time in the wards, from the routine examination of pregnant women by pelvimetry and palpation and auscultation. He may then induce labor, and thus secure more favorable conditions for delivery than would otherwise obtain. Should he be called to a patient having a contracted pelvis and already in labor, the history of a previous labor may give him a valuable cue. If the patient be a primipara, it becomes necessary to ascertain the form of pelvic disproportion present, the comparative size of the fœtus, and to consider any anatomical peculiarities which the patient may have as a primipara which are factors in choosing a mode of treatment. The form of pelvic disproportion may be determined by external pelvimetry, by internal measurements if the head has not engaged in such a manner as to make the sacral promontory inaccessible, and by the position of the child's head if it has engaged.

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[1] The writer once had occasion to apply forceps to the head of an undersized fœtus at the pelvic brim in a woman markedly syphilitic, in whose cervix syphilitic cicatricial tissue prevented dilatation. By the exercise of the greatest caution mother and child were uninjured. The blades grasped the head over the face and occiput, but normal rotation occurred during delivery by intermittent tractions.

[2] An interesting discussion on version *vs.* forceps in contracted pelves, between Goodell and Elwood Wilson, is found in *Trans. Phil. Obstet. Soc.*, May, 1875. Goodell championed version, quoting extensively from modern obstetricians, while Wilson advanced arguments for the supremacy of the forceps. The discussion illustrates the progress of obstetric science and the opposition which partisans of the forceps have made to other modes of treatment.

In flat, non-rhachitic pelves the head will often be found with its occipito-frontal diameter in the transverse diameter of the pelvis, while the parietal eminences occupy different pelvic planes. In symmetrically contracted pelves, should the head engage, the vertex will descend, the occipito-frontal or suboccipito-bregmatic diameter occupying an oblique pelvic diameter or possibly the conjugate. But each contracted pelvis is peculiar in its configuration, and hence the variation in the position of the head and its degree of moulding in these cases. Should the pelvic disproportion be very great, the head will be found above the pelvic brim, often in an iliac fossa. The comparative or proportionate size of the head can best be determined by the procedure of Müller[1] and Hofmeier, pressing the head downward into the pelvic canal by force applied above the pubes. If the head has begun to descend, the possibility of its further progress may be estimated by locating with the examining finger the spines of the ischia; if the head with its greatest biparietal diameter has passed a line drawn between the spines of the ischia, it can emerge from the pelvis.[2]

The consideration of the difference in structure between the expulsive or muscular and the elastic segments of the uterus readily explains the different conditions which obtain in primiparæ and multiparæ the subjects of pelvic contraction. Not only is the uterine muscle of the primipara more firm than that of the multipara, but the inferior or elastic segment of the uterus is much stronger and capable of far more resistance and elastic force in the woman in her first labor than subsequently. The obstetrician will therefore expect that the primipara will be able to exercise sufficient expulsive force to cause the head to engage in a contracted pelvis of minor grade, when in the multipara over-distension of the elastic segment and failure to engage will result. Remembering the cardinal function of the forceps, that of traction, he will naturally be justified in supplementing the expulsive forces of a primipara, in whom the head has engaged and moulded, by axis traction, provided no obstacle to delivery exists at the pelvic outlet. With multiparæ the conditions are more often favorable to version by reason of the greater elasticity of the lower uterine segment and the inferior expulsive force of the uterine and abdominal muscles. It has been shown by numerous obstetric writers that the head accommodates itself best to the pelvic canal when not in the embrace of a rigid instrument like the forceps. If the natural forces have not accomplished the first step in delivery—namely, moulding and engagement of the head—version is to be favorably considered.

Numerical measurements are commonly quoted as furnishing indications for a choice between forceps, version, craniotomy, and Cæsarean section. Experience has shown that the selection of a mode of delivery rests upon too many factors to enable the obstetrician to base his choice upon a certain number of inches in a given pelvic diameter. A careful estimate of the proportionate size of mother and child, of the mechanical obstacles to be overcome, and the mechanical power at hand to accomplish this end will furnish rational grounds for a choice of procedures: this choice should be based very largely upon the history of former labors if they have occurred. If a woman has once been delivered of a living child, a second child of the same father can probably be born alive: bearing in mind the anatomical and physiological differences between primiparæ and multiparæ, a woman with a moderately contracted pelvis may partially deliver herself in a first labor completed by forceps, while subsequent pregnancies may be terminated by the induction of labor or version with safety to mother and child.

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[1] *Samml. klin. Vorträg.*, Leipzig, 1885, No. 264.

[2] Professor Spaeth, Vienna.

Certain general rules may be stated as aiding in determining the treatment of these cases. In flattened pelves forceps should not be employed at the brim. The head engaging in the transverse diameter of the pelvis, the application of the forceps would be to the face and occiput, resulting in compression of the head and increase in the biparietal diameter already engaged. Rotation and accommodation would be retarded by this procedure; the maternal tissues would be in danger of injury from the ill-applied blades, while the child's life would be jeopardized by pressure upon the neck. If the head has not firmly engaged, version is indicated; if engagement has occurred, descent should be awaited, when, if needed, the forceps may be applied in the pelvic canal or at its floor, and delivery effected after methods ordinarily employed. In symmetrically-contracted pelves of moderate contraction, the child being of medium size, and engagement having occurred, axis traction is indicated, the mother's expulsive forces failing. If engagement has not occurred and efforts to favor it fail, version is preferable. In cases of great disproportion between the birth-canal and fœtus the forceps are contraindicated, and their use can result in disaster only.

Regarding the pelvic dimensions which justify forceps, Carl Braun, writing before the improvement in Cæsarean section, allows *tentative* traction with forceps when the antero-posterior diameter of the pelvic inlet measures 3.12 inches, the head engages and moulds, the caput succedaneum increases, and the mother's expulsive forces fail: if the head does not readily descend, traction must cease.[1] Pinard expresses the views of the French by limiting tentative traction to the same measurement, with the same precautions. But these opinions are based upon the state of obstetric science before the modern data already stated were available as a basis of judgment.

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[1] *Lehrbuch der Geburtshülfe.*

It may, therefore, at the present day be held that, while 3.12 inches is the shortest antero-posterior pelvic diameter justifying a cautious attempt at forceps delivery *when the head has engaged*, with this measurement, should the child be large and the head not engage, Cæsarean section should be kept in mind; forceps should be used with extreme caution as a tentative instrument only, and the mother should be given the election of Cæsarean section before her tissues have become bruised and œdematous. If the head has not engaged and begun to descend, the forceps must not be applied. The well-known views of Schroeder on this point may be here referred to—opinions which have greatly influenced usage among German obstetricians. An antero-posterior diameter of 3.7 inches generally permits delivery spontaneously; for a lesser measurement he deprecates the forceps, even in tentative tractions, advises version, and, when the conditions are not favorable for version, Cæsarean section or craniotomy. While exceptionally skilful forceps-operators have contested Schroeder's views, it cannot be doubted that they furnish a safe limit for the application of forceps in contracted pelves. Data suitable for the guidance of obstetricians of average skill are most valuable in forming current opinion and improving obstetric practice.

FORCEPS TO THE AFTER-COMING HEAD.

The application of the forceps to the head in breech deliveries has been warmly commended and as warmly condemned. In cases where the size of the pelvis and the head are proportionate there are better methods of completing delivery. When unusual rigidity of the pelvic floor and external genitalia is present the forceps may be indicated to overcome this rigidity with sufficient rapidity to save the child's life. When the pelvic outlet is deformed or malposition of the head exists, the forceps is often an efficient means of extracting the head, but with laceration of the cervix or perineum. The forceps, in head-last deliveries, is a lesser evil, only to be invoked to avoid a positive danger to the child's life. When the abdomen of the child is turned to the mother's abdomen and the chin presents anteriorly, the trunk should be raised and the forceps applied beneath the child's back; the occiput will rotate posteriorly, and is to be brought over the pelvic floor by the forceps. With the occiput anterior, the back of the child to the mother's abdominal surface, the forceps may be applied beneath its abdomen; the chin will rotate to the pelvic floor, and is to be flexed over the perineum by the forceps. The blades should be applied to the sides of the head, and as completely as possible, to avoid danger to the maternal tissues from their projecting tips. Although the cases in which the use of the forceps in breech labors is required are very infrequent,[1] the instrument should be at hand, properly cleaned and immersed in a warm solution of 5 per cent. carbolic acid in these cases. Axis-traction forceps are preferable in cases where delay is not entirely dependent upon the rigidity or stenosis of the vulva, but results from failure of rotation.[2]

THE FORCEPS TO THE SEVERED HEAD.

It occasionally happens that after decapitation the head remains unengaged at the pelvic brim. Should an effort to grasp it with forceps be determined upon, the head must be brought to engage, if possible, by suprapubic pressure; it must at least be firmly held until the blades are properly adjusted. If necessary, the hand may be inserted in the uterus and the blades guided in this manner.

THE SECONDARY AND EXCEPTIONAL FUNCTIONS OF THE FORCEPS.

Although the forceps is recognized as primarily a tractor, occasions arise in which its secondary and exceptional functions are called into consideration. The propriety of using the instrument as a compressor, rotator, lever, and protector of the perineum has been the subject of frequent and earnest discussion. As more exact knowledge of the anatomy of the parts involved and of the physiology of the process of parturition has become current, together with increased safety in manipulation, these secondary functions of the forceps have been more and more completely subordinated to the natural mechanism of labor. As has been stated, compression of the head by forceps beyond the point of securing a firm grasp results in frustrating nature's efforts to accommodate the head to the pelvis and in injury to the child. As a rotator the forceps is inferior to the agents which normally produce rotation, and as an instrument it is not to be preferred to the aseptic hand. As a lever Galabin[3] has shown that the forceps must be considered as forming a single bar, not included in the divisions made of levers nor conforming to mechanical laws. The fulcrum results from power being exerted downward and slightly to one side. Pendulum tractions are superfluous in ordinary cases of inertia of the expulsive forces, and it is difficult to recognize their utility in complicated cases. That they can do great harm has been exemplified. Traction with forceps should be uniformly gradual and intermittent, of moderate force, with very limited compression, and in the axis of the birth-canal.

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[1] See a recent discussion in the German Society for Gynecology in which twenty-one methods of delivering the after-coming head were mentioned (*Münchener medizinische Wochenschrift*, No. 22, 1888).

[2] Credé (*Archiv für Gynäkologie*, Band xxv. Heft 2, 1885) reports 16 cases of forceps to the after-coming head—8 in normal, 8 in slightly-contracted pelves. His results were, maternal mortality 1, fœtal mortality 4. Credé advises forceps in these cases when the antero-posterior diameter of the inlet is 3.5 inches.

[3] *Obstetrical Journal*, November, 1876.

There remains, however, the function of the forceps as a preserver of the perineum, in which its conservative character as an instrument is well illustrated. In precipitate labors, where from excessive irritability of the nervous system the mother's expulsive forces cannot be controlled, the forceps applied to the head at the pelvic floor may be used successfully to preserve flexion by lowering the handles, governing the descent of the head, and the dilatation of the vulva and the tension of the perineum. The instrument is especially useful in those cases where anæsthetics are not admissible. The emergence of the head is not hastened, but delayed by this application of the forceps; and it is held by Duer and other American obstetricians of wide experience that in precipitate labor the perineum may thus be efficiently protected. This is not a procedure for those unskilful and inexperienced in the use of forceps, but for experienced and accomplished operators.

THE MORBIDITY AND MORTALITY OF FORCEPS APPLICATIONS.

To the Mother.—With proper antiseptic precautions the maternal morbidity from the use of forceps is inconsiderable. If the maternal tissues, swollen by the pressure occurring in delayed labor, are not infected by the operator or instrument, the increased risk of disease to the mother is very slight when the instrument is applied to the head at the pelvic floor. The risk increases with the presence of variations from occipito-anterior positions, which give increased frequency of mechanical injury. Tumefaction and soreness of the vulva and vagina are the mildest of the affections caused by forceps. Should septic infection occur, the case may be limited to lymphangitis of the vagina and cervix, without infection of the endometrium or constitutional implication. In rare cases the simplest forceps delivery, without laceration of the perineum, may be followed by septicæmia and death. While laceration of the perineum offers greater risk of infection, immediate suture under antiseptic precautions renders this complication of less importance than formerly. In difficult forceps deliveries the vaginal fornices may be torn, the septa between the bladder and rectum and vagina perforated, the cervix lacerated, and the perineum ruptured, rarely into the bowel. Such injuries are unwarrantable and very exceptional, and the most difficult delivery should not necessitate a greater injury than superficial lacerations of cervix and vagina and moderately ruptured perineum, which generally heal promptly under antiseptic precautions.

The maternal mortality from forceps, aside from these severe and unwarrantable injuries, results from septic infection. It is found, naturally enough, that in proportion as antiseptic precautions are enforced and judgment is shown in using the instrument, the mortality becomes almost *nil*, as is the case in the best maternities at present. The improper use of forceps in deformed pelves is most fatal, the death-rate among mothers having been 30 to 40 per cent. When, however, the forceps is used intelligently in contracted pelves, the mortality compares favorably with that of the other methods of treatment for this condition. Thus, Winter[1] reports 98 cases of forceps deliveries occurring in 632 cases of contracted pelvis, with a maternal morbidity of 8 per cent. and a mortality of *nil*. These deliveries were made with a full understanding of the modern data already referred to, and with the aid of proper antisepsis: they exhibit the results of the discriminate use of the instrument. The indiscriminate use of forceps in contracted pelves results, as stated, in a maternal mortality-rate of 40 per cent.[2]

In forceps deliveries when the child and birth-canal are proportionate in size, the maternal mortality-rate is that exhibited in the best maternities from sepsis—0.72 to 0.42 per cent.[3]

To the Child.—The subject of injuries to the fœtus by forceps has been less perfectly studied than other points regarding the use of the instrument, and invites investigation. Fissures in the fœtal scalp, depression of the bones of the skull, occasional fracture and compression of the brain, and rupture of cerebral vessels, have all been noted. Lomer in 27 cases of fracture of the skull by forceps found the lesion most frequently in the frontal bone; in 6 cases the sagittal suture was ruptured, and in 4 the lambdoid.[4] Among the milder injuries following forceps delivery paralysis of the facial nerve is most frequent. This was early described by Landouzy,[5] and subsequently studied by Parrot and Troissier,[6] who found the change in the nerve in severe cases to be a fatty degeneration resembling that which follows section of a nerve-trunk. Ordinarily, the affection is mild, and disappears spontaneously in a short time. In 86 cases of axis traction Bumm reports 8 cases of facial paralysis and wounds of the integument; 9 children were asphyxiated, 6 severely.[7]

Regarding the influence of compression exercised upon the fœtal head by the pelvis or the forceps in the production of paralysis, recent investigations have added to our previous knowledge. Gowers[8] describes cerebral palsies as following difficult labor, generally accompanied by extravasation of blood upon the surface of the brain, ending in death or tedious recovery. Osler,[1] in reviewing the literature of the subject, has found that cerebral palsy in children is not commonly recognized as caused by forceps; he adds nine cases which he has personally observed of children delivered with forceps and palsied. That defective and retarded cerebral development may follow undue compression of the head by forceps, and paresis and paralysis, is more than probable. Any depression in the cranium of a newborn child must not be ascribed to violence at birth, for Osiander and Carl Braun describe fissures of considerable depth following easy delivery. Fortunately, of very rare occurrence are those cases of terrible injury to the cranium and scalp in which a forceps blade pierces the scalp and crushes the bone.

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[1] *Zeitschrift für Geburtshülfe*, Band xiii. 1886.

[2] Hugenberger and Williams.

[3] Fischel: *Centralblatt f. Gynäkologie*, Nos. 32 and 33, 1888.

[4] *Zeitschrift für Geburtshülfe und Gyn.*, Band x. p. 334.

[5] *Gazette méd. de Paris*, 1839.

[6] *Archives de Tocologie*, 1876.

[7] *Sammlung klin. Vorträge*, Leipzig. No. 318, 1888.

[8] *Lancet*, April 14–21, 1888.

Sloughing of the scalp from compression is more often seen, and may result independently of fracture. Parvin[2] has collected instructive cases of sloughing of the fœtal scalp, occurring after instrumental labor, and exceptionally after spontaneous delivery.

The mortality among children delivered with forceps where the pelvis and the fœtus are proportionate in size is slight. Indeed, it may be questioned whether the forceps properly used is not an effective agent in lessening fœtal as well as maternal mortality. In marked contrast to this conservative influence upon fœtal life is the result of the injudicious use of forceps in contracted pelves. Hugenberger and Williams report 70 per cent. and 60 per cent. fœtal mortality respectively from this cause. That a fatal issue to the fœtus is not a necessary result of birth in contracted pelves is shown by Winter,[3] who reports but 15 per cent. fœtal mortality among primiparæ and 13 per cent. in multiparæ where this complication existed and the use of forceps was practised with reference to the anatomical and physiological conditions present in each patient. Poppel has estimated fœtal mortality from forceps at 10.8 per cent., and Spiegelberg at 17 per cent.

In common with the results obtained with mothers, it may be concluded that when rationally employed the forceps does not increase fœtal mortality, but is a truly conservative instrument. When irrationally used, it is capable of doing great damage. Regarding the morbidity following its use, Osler[4] found, in reviewing the literature of cerebral palsies in children, no statement directly charging the instrument with this result. With this the recent observations of Lovett agree,[5] who in 60 cases of cerebral paralysis in children could trace no connection with forceps delivery. It remains to be determined whether causes affecting fœtal life *in utero* are not the more potent factors producing such lesions, and not the forceps. There exist, however, a sufficient number of cases of injury from this source to render caution in using forceps an imperative duty.

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[1] *Medical News*, July 14, 1888.

[2] *Ibid.*, November 12, 1887, p. 562.

[3] *Op. cit.*

[4] *Op. cit.*

[5] *Boston Med. and Surg. Journal*, 1888, pp. 118, 641.

ACCIDENTS ACCOMPANYING FORCEPS DELIVERIES.

The most frequent mishaps in the use of forceps not to be directly imputed to the operator's carelessness are the slipping of the instrument and separation of the symphysis pubis. If care be taken to apply the blades to the head, and as perfectly as possible, the forceps will rarely leave the head: a slight change in position will often occur, especially when forceps are applied to the sides of the pelvis. In consulting practice more than a single instrument is usually available, and should one slip with tentative traction, a second whose cephalic curve is better adapted to the configuration of the head should be selected. A decided failure in apposition of the blades should result in their withdrawal and reapplication.[1]

Separation of the pubic symphysis may occur after forcible traction, and also with the exercise of but moderate force. Thus, Faux reports[2] a case in which crepitus was perceived during axis traction with Tarnier's forceps in a primipara aged twenty-five, the position being right occipito-posterior, although but moderate force was exerted. The diagnosis was confirmed after labor; uninterrupted recovery followed. The reader is also referred to cases reported and discussion by Dührssen, Olshausen, Veit, Martin, and Gusserow.[3] Cases of traction which straightened the blades of the forceps, or in which the blades left the head with great suddenness, or in which the tractile force of several individuals was combined, cannot be regarded illustrations of the skilful use of the instrument: failure to make axis traction or the choice of an inferior instrument is generally the fault in these occurrences.

THE FREQUENCY OF FORCEPS APPLICATIONS.

An estimate of the frequency with which the forceps is used in private practice is not readily obtained. Patients sufficiently well-to-do to be confined at home are often inferior in muscular development to hospital patients, who come more frequently from classes engaged in manual labor. Among the former failure of expulsion through muscular exhaustion is not infrequent, and hence the forceps is often used. The statistics of private practice are rarely available, and the usage of the best maternities may be taken as furnishing an approximate estimate of good practice in private. Forceps applications to save the time and convenience of the operator are not included in this category. Pinard[1] estimates that before the invention of axis-traction forceps 11 European operators applied the forceps 113 times in 117,000 births. Tarnier, in the twenty-nine years preceding his invention, in 55,000 births at the Maternité used forceps once in 97 labors in normal pelves, once in 275 births in contracted pelves. Early statistics of the Rotunda Hospital at Dublin give 1 application in 700 births. The improvement of the instrument and its more skilful use have led to its more frequent application in appropriate cases, while increased knowledge of the normal mechanism of labor has limited its unnecessary employment. In proportion as version is favored in contracted pelves the forceps is not used, and where pelvimetry is practised induced labor, version, and craniotomy lessen the number of forceps operations. In Spaeth's clinic in Vienna, in 2761 births in 1885, the forceps was used 77 times—once in 35+ labors. In the Rotunda at Dublin,[2] during three years ending 1886, 203 forceps applications occurred in 3414 births—1 in 16. At the Royal Maternity of Edinburgh the average use was 1 in 10.6 for one quarter of a year.[3] This proportion included 1 case with axis-traction forceps to each 88 births, while in the Simpson Memorial Hospital 1 in every 7.2 labors was completed by axis-traction forceps.[4] These recent statistics agree with the earlier estimate of Churchill to the effect that forceps are used twice as often in England as on the Continent. Going to the other extreme of modern obstetric practice, we find Ahlfeld reporting but 3 forceps deliveries in 308 labors—1 in 102.[5] He has, however, revived an ancient procedure, that of placing the woman on a birth-stool to facilitate the descent of the fœtus.

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[1] Cleeman (*Trans. Phil. Obst. Society*, 1877-78, vol. v.) has added a pelvic curve to the shank of the forceps, to prevent slipping.

[2] *Bullétin de la Société obstétricale de Paris*, No. 8, 1888.

[3] *Centralblatt für Gynäkologie*, No. 49, 1888, p. 813.

The frequency of forceps deliveries in American maternities may be said to occupy a position between the statistics quoted. In the Philadelphia Hospital,[6] during 1887, the forceps was used once in 27 labors, and the rules of the institution are such that the instrument is not hastily resorted to. In 112 deliveries at the Boston Lying-in Hospital forceps were used 7 times, = 1 in 16 labors.[7] It is probable that forceps cases are more common in private practice than in maternities, where the discipline of an institution forbids their use without a positive indication.

THE VECTIS.—The secret instrument sold by Hugh Chamberlen to Roonhuysen, and made public in 1753 by De Vischer and Von der Poll, was most probably the vectis. By some the invention of the vectis is ascribed to Roonhuysen, but this is denied by others. The instrument became most popular in England, where it attained equal rank with the forceps. At the present day it is a favorite with but few obstetricians, and, in spite of occasional attempts to popularize its use, it is now, in America at least, a curiosity. The original instrument is said to have been a curved plate of steel; in its most approved form it is practically the blade of a short straight forceps, often inserted in a wooden handle. The handle has been occasionally hinged for greater convenience of carriage. Among American obstetricians Hodge advocated its use to perfect flexion and aid rotation. Modern Continental obstetricians consider the vectis a superfluity and not to be commended. Fabbri of Bologna has employed it successfully, and Goodell has found his method of advantage, and describes it as follows:[1] "In those transverse cranial positions at the brim due to a contraction in the conjugate diameter, whenever the blades cannot be applied to the sides or to the fronto-mastoid diameter of the head, the following method will be found of signal advantage—of far greater, in fact, than the application of the forceps over the face and occiput: The tractor passed over the pubic side of the mastoid region is at first used as a lever of the first kind, the left hand on the shank representing the fulcrum, and the right hand becoming the power by raising the handle toward the pubes; in other words, each hand acts in opposite directions, the left one mainly to protect the pubes from pressure. As soon as the hand is raised high enough for the blade to secure a good purchase, and also to compress the offending transverse diameter of the head, then traction is thus made: The right hand is kept at rest to become the fulcrum of a lever of the third kind, while the left acts as the power. This compound action of traction and leverage meets here several important indications. It compresses the head in its lateral diameter, flexes it, and forces its pubic side to revolve around the promontory of the sacrum as the centre of motion, to slide over the smooth surface of the pubic symphysis, and to roll over into the pelvic cavity."

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[1] *Dict. Encyclop. des Sciences médicales, loc. cit.*

[2] *Dublin Journ. Med. Sciences*, 1887, p. 472.

[3] *Edinburgh Med. Journ.*, Sept., 1888.

[4] *Ibid.*, Oct., 1888.

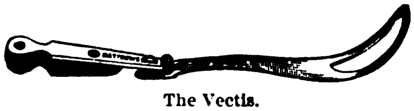
[5] *Deutsche med. Wochenschrift*, Nos. 23–28, 1888.

[6] *Annual Report Dept. Charities and Corrections*, 1887.

[7] *Boston Med. and Surg. Journ.*, Aug. 30, 1888.

In comparison with the forceps the vectis is better available as a lever, as the hand readily furnishes a fulcrum, and the handle is better adapted for this purpose than the forceps handles. Its safety as a lever lies in the fact that the fulcrum is not made by the maternal tissues, but by the hand. In the hands of an expert it may occasionally render valuable service, but the desuetude into which it has fallen is a

FIG. 38.



The Vectis.

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[1] *American Practitioner*, January, 1873.

striking proof that rotators and levers other than those furnished by nature are rarely useful, and for practical purposes are superfluous.

The vectis represented in the accompanying illustration is that commonly used in England, and has a hinged handle.

EMBRYOTOMY.

Among the oldest of obstetric operations is that for lessening the size of the fœtal head. The Father of Medicine invented a curved knife for opening the cranium and an instrument for crushing the bones. Celsus and Soranus practised opening the head with a knife and extracting fragments of bone with bone-forceps, while the Arabians possessed a complete armamentarium of instruments for the destruction of the fœtus. The temporary loss of the operation of version during the Middle Ages increased the frequency of destructive operations, until Ambrose Paré, in 1550, restored version to its deservedly important place among obstetric resources.

The destructive operations have been at times abused, and again neglected. Thus, Osiander the elder boasted that in forty years' practice he had never done craniotomy, while, with the irony of fate, his son performed the operation in his father's clinic in Göttingen while the elder lay dying. Playfair writes that at one period in the history of English obstetric science the forceps was supplanted by craniotomy at the Dublin Rotunda Hospital, 21,867 births having occurred without a single employment of the conservative instrument; at another time craniotomy was done three or four times as frequently as forceps delivery. It is probable that at present the improvement in Cæsarean section is inaugurating a period of comparative neglect for the destructive operations; in fact, the belief is expressed that destruction of the living fœtus has ceased to be justifiable, and that the non-viable fœtus only shall be subjected to partial destruction. While this may be questioned, views formerly accepted regarding the destructive operations must be essentially modified, and a complete reversal of many obstetric dicta seems the duty of the hour.

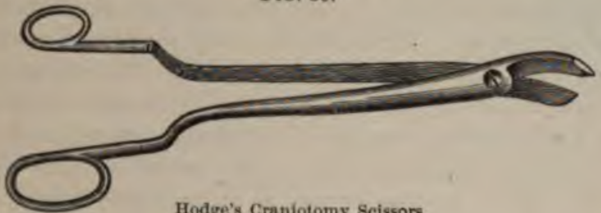
From the standpoint of ethics the destruction of the living child has always been regarded with horror. Common law was early invoked to decide whose right is paramount in these cases—that of mother or child. Following the dictum of Cicero, that life is to be preserved which is of most value to the state and society, and that life is the mother's. This principle has been repeatedly recognized in affairs of state, as illustrated by Napoleon I. But the sacrifice of the fœtus in these cases is based upon the premise that embryotomy is less dangerous to the mother than Cæsarean section. While it may not be asserted at present that the Cæsarean section offers invariably as good a chance of recovery to the mother as embryotomy, yet her chance for life and health under the former is so vastly improved with the modern operation that this ancient premise is greatly weakened, and the obstetrician is called to make his decision and to advise his patient on grounds which have existed but a short time and which mark the growth of obstetric science. The proportions of the dead fœtus may be altered at the judgment of the operator in the mother's interest without hesitation; and in this regard the destructive operations are sometimes neglected, it being not infrequently safer to perform craniotomy upon a dead fœtus than to deliver the head by forceps before its size is lessened.

THE INDICATION FOR PERFORMING AN OPERATION DESTRUCTIVE TO THE FŒTUS.—In general, disproportion between the size of the fœtus and the pelvis or birth-canal is the indication for materially lessening the fœtal proportions. The pelvic measurements which may be relied upon as absolute indications have been questioned, and the many factors which enter into a decision regarding the choice of a mode of treatment in serious complications of labor render in this instance the choice of embryotomy a matter of comparative judgment, and not an arbitrary selection.

Such disproportion may result from abnormally advanced ossification and development of the skull—from hydrocephalus or from the presence of a fœtal monstrosity. On the side of the mother contraction of the pelvis is the most frequent indication: abnormal rigidity or deformity of the pelvic floor may require the lessening of the fœtal proportions. An abnormal relation of the fœtal diameters and those of the pelvis may indicate embryotomy, as when the chin of a fœtus normal in size rotates into the hollow of the sacrum in a normal pelvis; a neglected shoulder presentation with impaction may call for embryotomy. The relative indications for the destructive operations will be discussed when the recent statistics of these and more conservative procedures are considered.

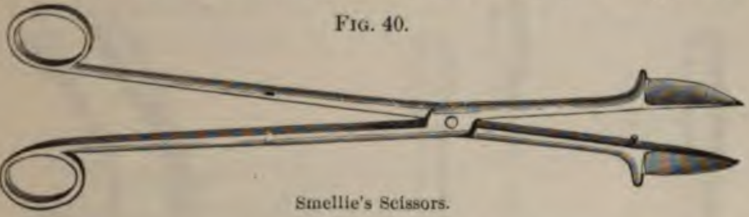
CRANIOTOMY AND EMBRYOTOMY.—As the head most frequently presents, and furnishes the greatest obstacle to birth, so it is the portion of the fœtus most often to be reduced in size. Craniotomy, lessening materially the diameters of the fœtal head, is the most frequently performed of the destructive operations. Embryotomy may be applied in general to all destructive operations: in distinction from craniotomy, the various procedures for severing the trunk or evacuating one of the trunk-cavities have received names descriptive of each particular operation. The manner in which the diameters of the head are lessened has introduced descriptive terms into the nomenclature of craniotomy. Thus, cranioclasm and cephalotripsy describe not only the piercing of the head, but crushing its parts; this is exemplified in basiotripsy, breaking up the base of the skull. Again, the nomenclature of instruments has added technical terms to those descriptive of the operation only. Embryotomy may be considered, however, an appropriate term for any operation destructive to the fœtus, and craniotomy may be conveniently used as indicating the destructive operation most frequently performed, describing as it does the seat of the operation.

FIG. 39.



Hodge's Craniotomy Scissors.

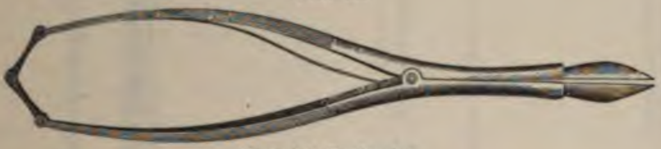
FIG. 40.



Smellie's Scissors.

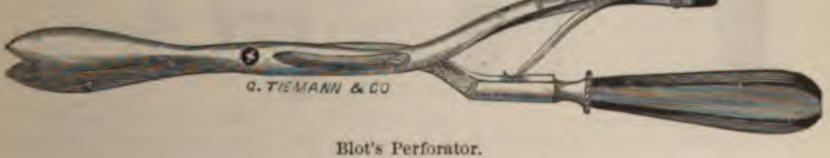
CRANIOTOMY.—The diameters of the fœtal head are most often lessened by perforating the skull and evacuating a portion of its contents. Perforators vary in simplicity from scissors to a trephine especially constructed for this purpose. Hodge's craniotomy scissors and Smellie's scissors are familiar types of the simplest perforator. More complicated but convenient instruments are Naegele's perforator and the spear-pointed instrument of Blot.

FIG. 41.



Naegele's Perforator.

FIG. 42.



Blot's Perforator.

Among German obstetricians a trephine is the favorite perforator, and the models of Braun and Martin are most often used.

A simple scissor-like instrument has the advantages of being manipulated with but a single hand of the operator and of being easily cleaned: its disadvantages are that the aperture made by it is often closed by the pressure to which the head is subjected, and thus the purpose of the operation is defeated. Then the evacuation of the brain is not so readily accomplished. The trephine perforator, by removing a disk of bone, makes a permanent opening in the cranium through which an irrigating tube may be passed and the brain thoroughly removed by a forcible douche of antiseptic fluid. The most recent models of trephines are composed of three simple parts, which can be taken asunder and thoroughly cleansed.

FIG. 43.

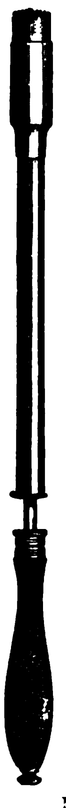


FIG. 44.

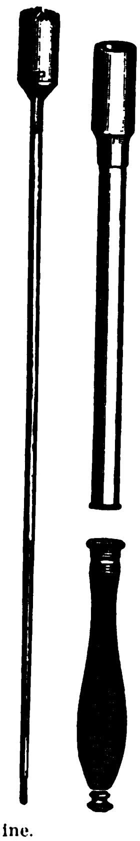
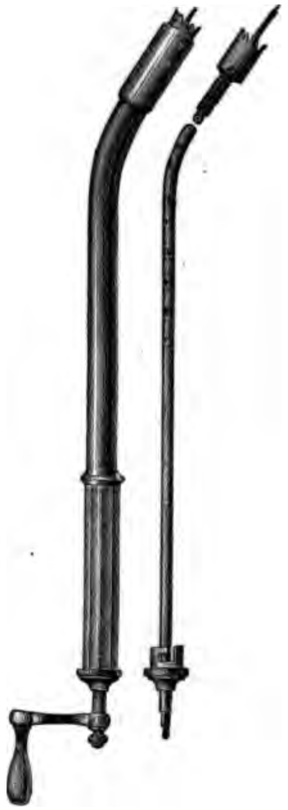


FIG. 45.



Martin's Trephine.

Parts Together. Taken Asunder.

Braun's Curved Trephine.

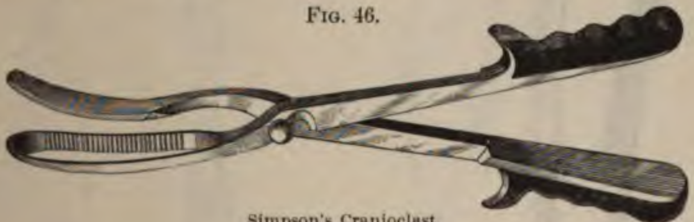
In using the simple scissor-like perforators it will often be convenient to pierce a suture or fontanelle, and if the disproportion in the size of the head is not excessive, the long-continued pressure of labor will evacuate sufficient of the cranial contents to allow birth to take place. In performing craniotomy with the trephine the cranial opening should not be in a suture or fontanelle, but through the unbroken cranial wall.

Martin's trephine (Figs. 43, 44) is simple in its construction and readily cleansed: it is straight. Carl Braun's curved trephine is more complex and less easily cleansed and disinfected.

Simple perforation of the skull and the evacuation of a portion of its contents rarely suffice to lessen the diameters of the head sufficiently to admit of spontaneous delivery. The base of the cranium commonly offers the greatest obstacle to the birth of the head, and hence its size must be lessened. This is accomplished by the pelvic walls when traction is made upon the perforated and partially emptied head, or by an instrument selected for the purpose.

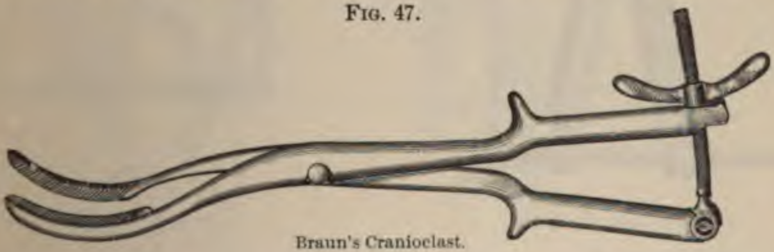
If perforation be performed and traction and counter-pressure from the pelvis be chosen, the use of the cranioclast should follow the perforation. This instrument is virtually a strong prehensile forceps, one blade of which is passed within the cranium, while the other grasps the wall of the skull from without. The cranioclasts most used are Simpson's and Braun's. The former was intended to combine a crushing instrument with a traction forceps. The larger blade, heavily grooved, is to be applied without the cranium, while the smaller, possessing ridges which fit the grooves of the first, is inserted within the skull. The lock is a button joint, and the compressing power must be directly exercised by the operator. By rotary movements of the blades various portions of the skull may be grasped and broken, and the weight

FIG. 46.



Simpson's Cranioclast.

FIG. 47.



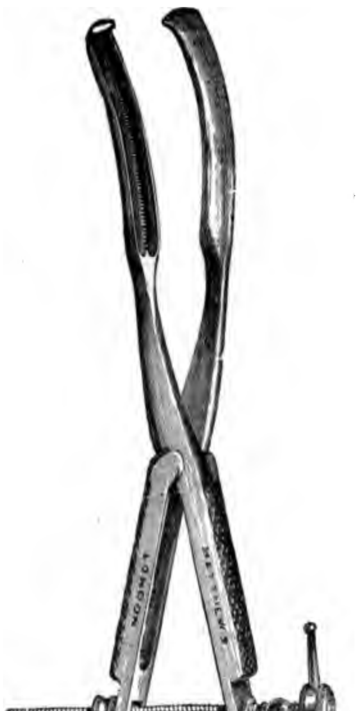
Braun's Cranioclast.

and strength of the instrument are provided for this purpose. As a tractor it is most effective; as a crushing instrument it is excelled by the cephalotribe. The original Simpson model lacked a pelvic curve.

Braun's cranioclast, lighter in weight than Simpson's, is designed for traction only. The construction and mode of application of its blades resemble, in their cephalic portion, Simpson's instrument: the grasping power is exercised by a compressing screw at the extremities of the handles. It possesses the button lock and a pelvic curve. Braun's cranioclast fulfils the purpose for which it was designed most admirably.

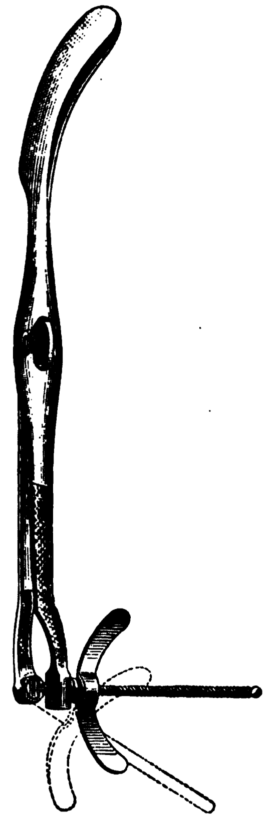
When the operator wishes to break up the skull at the time of perforation, a cephalotribe is to be preferred. This instrument is the invention of Baudelocque (the nephew), and was given to the profession in 1829, with the hope and expectation that it would supersede the perforator. This hope has not been realized, and while the cephalotribe is a valuable supplement to the perforator in very firmly ossified and large heads, yet in the majority of cases it is inferior to the cranioclast as a

FIG. 48.



Hicks' Cephalotribe.

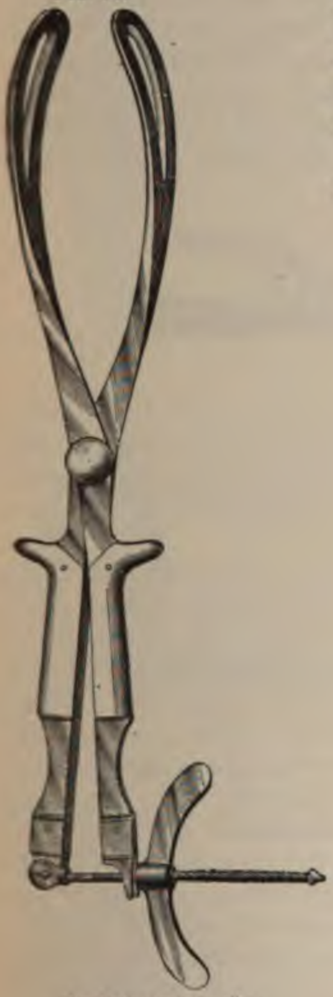
FIG. 49.



Blot's Cephalotribe.

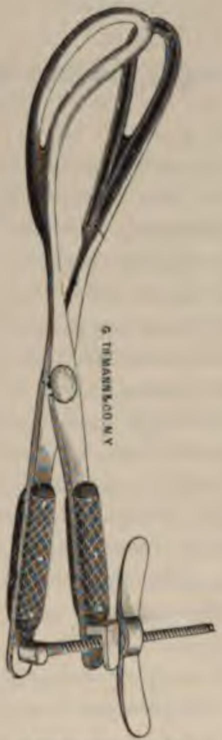
means of delivery. Various non-fenestrated forceps[1] with a compressing screw have been used as cephalotribes. Principally in use are the instruments of Hicks, Blot, and Breisky, and in America the model of Lusk. The two former (Figs. 48, 49) are narrow strong forceps, with non-fenestrated blades, and compressing screw at the extremities of the handles: the instrument of Hicks has no pelvic curve. The instruments of Breisky and Lusk (Figs. 50, 51) are heavy forceps with cephalic and pelvic curves; in Lusk's cephalotribe the inner aspect of the blades is deeply grooved.

FIG. 50.



Breisky's Cephalotribe.

FIG. 51.



Lusk's Cephalotribe.

The original instrument of Baudelocque was large and very heavy, and was soon modified, as the opinion gained ground that perforation should first be done and then the cephalotribe applied. When the cranioclast proves inefficient to deliver the head after perforation, the cephalotribe may be employed if the pelvic contraction be not extreme. As some of the same objections exist to compression of the head by the cephalotribe which were stated regarding a similar use of the forceps, the cephalotribe should be limited to moderately contracted pelves. The models most resembling forceps, with a pelvic curve, are largely used.

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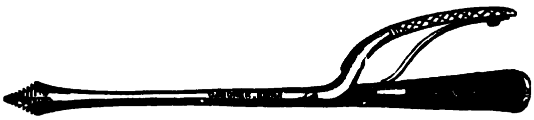
[1] For the recent advocacy of this instrument see J. Price, *Medical News*, Aug. 12, 1885, p. 219.

It not infrequently happens that the direct application of force to the base of the cranium is necessary. For this purpose the basilyst of Simpson[1] and the powerful basiotribe of Tarnier have been devised. The former consists of a rod terminating in a bulb-shaped screw: the rod and its screw tip are split longitudinally, and the halves can be separated with considerable force by a device at the handle. After perforation the instrument is passed through the opening in the skull to the base of the cranium, in which its screw tip is inserted by a boring motion: when well engaged the halves are separated, and the fractured bone thus dislocated. The soft parts of the head ordinarily guard the tip from injuring the mother, as it is not necessary that the instrument project from the skull.[2]

FIG. 52.



Simpson's Basilyst.

The most complete invention for crushing the fœtal head, including the base, is the basiotribe of Tarnier.[3] This instrument consists of a central blade terminating at its cephalic extremity in a screw tip; this blade bears a button similar to that which the Naegele forceps possesses, and at its external extremity is shaped to afford a firm grasp. A longer and a shorter blade, shaped like the cephalotribe forceps, are joined like forceps blades, the central screw occupying the space in the concavity of their cephalic extremities. A compressing screw at the extremities of the cephalotribe blades completes the instrument. It is applied by perforating the cranium with the central bar by boring through the vault: the cephalotribe blades are then applied, and the base of the cranium broken up by crushing. As the head is secured by the perforator, the compression results in applying force directly to the base.

For the extraction of the head after perforation, or to remove portions of the skull after evacuation of its contents, crotchets and craniotomy forceps may be employed. The former have been the objects of much reproach, but in skilful hands have served a useful purpose when the better instruments were not available. The latter are simply the blunt-edged bone-forceps of the surgeon, and may be straight or curved, as are his sequestrum or duckbill forceps.

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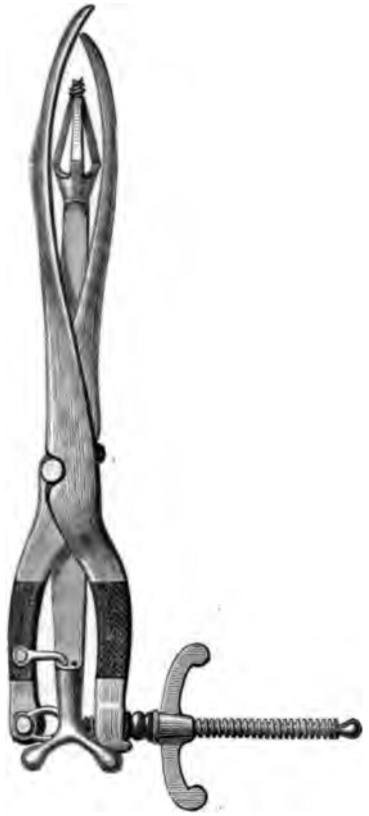
[1] *Edinburgh Med. Journal*, 1882 and 1883, pp. 769-778.

[2] J. Price (*loc. cit.*) has recently advocated a forceps perforator, the point of which is guarded by a leather shield, while the other blade carries a screw perforator for piercing the spinal canal.

[3] Bar: *Le Progrès médical*, Nos. 51 and 52, 1884.

FIG. 53.

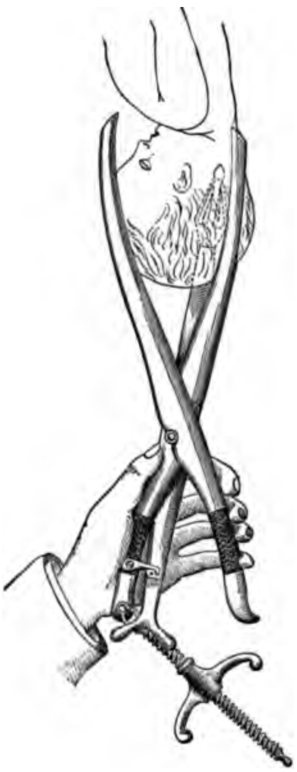


Tarnier's Basiotribe.

A most useful addition to the resources of the obstetrician who performs craniotomy is suitable apparatus for thoroughly evacuating the skull. For this purpose a firm canula and a strong piston syringe are requisite. The tube should be of considerable lumen: a full-sized catheter is the smallest tube which can be used to advantage. Better than this is Carl Braun's hard-rubber curved tube or a tube of block tin slightly curved, with perforations on each side of the tip of size sufficient to permit the passage of a full stream of fluid. It is also desirable that the canula be sufficiently strong to be used to break up brain tissue and tear the meninges. The syringe may be of metal, or preferably of hard rubber, to be used with solutions of bichloride of mercury. As the tube is introduced within the opening made by the perforator, the impetus of the fluid injected is confined within the skull, and hence no danger of the entrance of fluid or air into the uterine sinuses is caused by the injection.

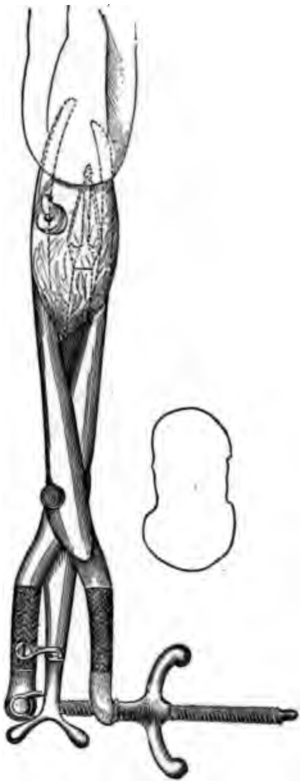
THE OPERATION OF CRANIOTOMY IN HEAD PRESENTATIONS.—When craniotomy has been determined upon, there are certain considerations, aside from the scientific aspect of the case, which pertain to the relations of the obstetrician to his patient and her friends. A considerable proportion of the religious world holds views regarding the destiny of the soul that perishes without the rites of the Church which render the destruction of the living fœtus a peculiarly momentous occurrence. Should the fœtus be living, the obstetrician will do well to give the patient and her family the fullest opportunity to secure the ministrations of the faith which they hold. He should not bear the responsibility of destroying the living fœtus without professional support when it can be obtained. In view of the present status of Cæsarean section the mother and her friends should be fully cognizant of the proposed operation, and should the fœtus be living they should be allowed to choose, after careful explanation, between the destruction of the fœtus and Cæsarean section.

FIG. 54.



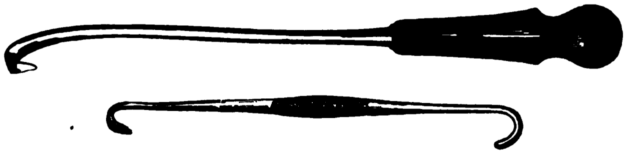
Application of Tarnier's Basiotribe.

FIG. 55.



Basiotripsy Accomplished.

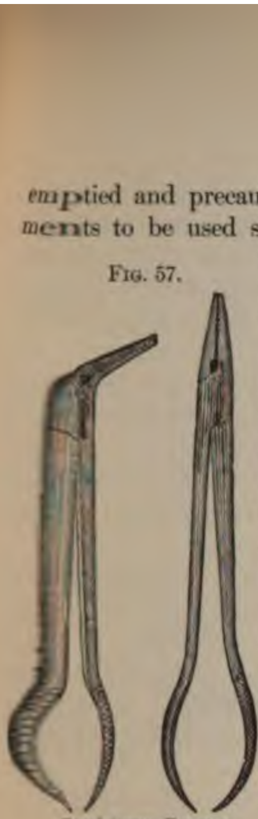
FIG. 56.



Crotchets.

Before proceeding to craniotomy the rectum and bladder should be emptied and precautions taken to secure strict antisepsis. The instruments to be used should be washed with soap and warm water and immersed in a 5 per cent. solution of carbolic acid. The external genitalia of the patient should be thoroughly washed with soap and water and a solution of bichloride of mercury 1 : 2000. She should be placed with her buttocks projecting over the edge of a bed or table, the limbs supported in chairs or held by assistants. A copious vaginal douche (not less than two quarts) of bichloride solution, 1 : 5000, moderately heated, should be given. The operator, having rendered his hands and arms aseptic, should sit before his patient, having his instruments within reach, and also a gallon of the mercuric solution, 1 : 5000, warmed. A bucket or pail which may be covered at once should be at hand to receive the fœtus. It will be best, in the majority of cases, to anæsthetize the patient, to spare her physical and mental suffering. An assistant should stand beside her to hold the fœtus firmly in position by suprapubic pressure.

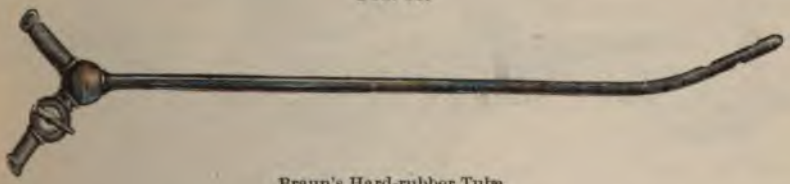
FIG. 57.



Craniotomy Forceps.

Having carefully determined the position of the head, if the operator use a scissor perforator the left hand should be inserted in the vagina and the perforator guided to a suitable point for piercing the cranium.

FIG. 58.



Braun's Hard-rubber Tube.

If it is deemed sufficient to pierce a suture or fontanelle and allow the expulsive forces of nature to partially empty the head and deliver it, the perforator may be introduced in this manner, being partially withdrawn, turned at right angles to its first insertion, reinserted, and the aperture enlarged. It is best, however, having entered the head, to

FIG. 59.

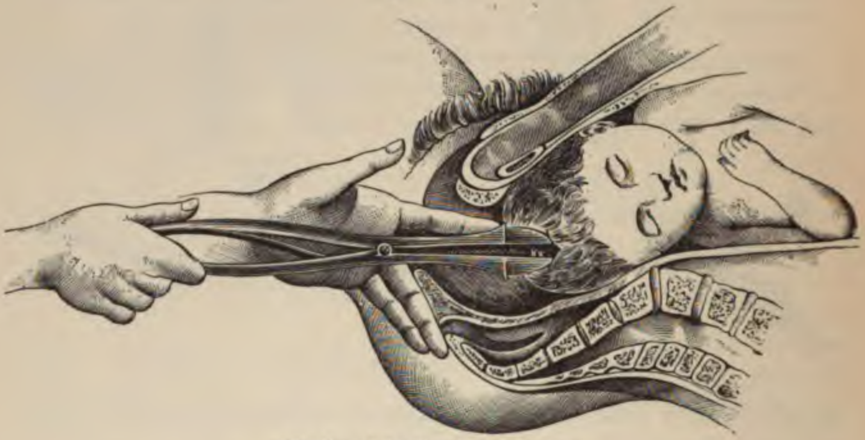
Hard-rubber Syringe.

break up the medulla oblongata and the brain, either with the perforator or the canula. The cranium should then be thoroughly evacuated by the injection of bichloride solution, 1 : 5000, with force sufficient to wash out the brain. If the simple perforator has been used, the escape of cerebral tissue will be less prompt and complete than when the trephine is employed.

In exceptional cases the head is left after perforation and evacuation to be normally delivered. This can be a justifiable procedure only when the woman has been so short a time in labor that her tissues are uninjured and when the fœtus is not macerated. It is, in the vast majority of cases, best to complete delivery after perforation and evacuation.

Whenever its application is possible the trephine is to be preferred for craniotomy. It makes a permanent opening through which cerebral tissue is freely evacuated, and readily permits the application of the cranioclast. To use the trephine great care must be exercised to hold it firmly against the cranium, and if the operator's grasp be not fully competent for this, an assistant should press the trephine firmly against the bone under the guidance of the operator's left hand, while with his right the crown of the trephine is rotated. A point should be chosen in bony tissue for trephining, and the operator will usually find a parietal bone or the occipital accessible. The cranium having been opened, the brain should be thoroughly broken up by pushing the trephine into the cerebral mass, or by any convenient instrument. The canula should then be passed to the base of the skull, and the warmed solution of bichloride of mercury, 1 : 5000, should be injected. The canula should be moved about until it is felt that the brain is thoroughly

FIG. 60.

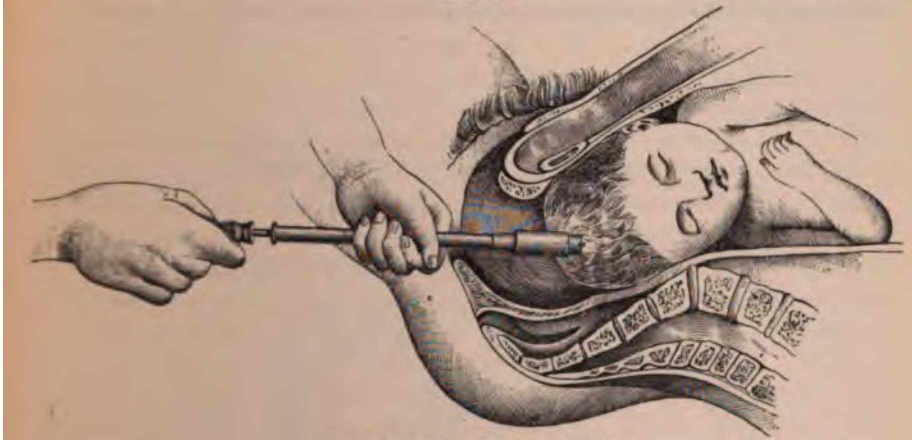


The Use of the Simple Perforator.

disorganized. The injection of fluid should be continued as long as the return current brings fragments of tissue with it.

Unless the base of the cranium is unusually large and firm, delivery should be completed by the cranioclast. The size of the blades of this instrument is adapted for its introduction through the opening made by the trephine. The left blade of the cranioclast, which, like the left blade of the forceps, contains the button of the lock, is passed first through the trephine aperture. This blade bears the solid, roughened cephalic portion which fits into a corresponding aperture in the right blade. The right blade is passed without the skull to receive the left blade covered by the soft parts in its grasp. By the compressing screw a firm hold is secured, and traction in the axis of the pelvis, in the manner in which the forceps is used, will complete delivery. The head ordinarily emerges flattened antero-posteriorly into an irregular cone.

FIG. 61.



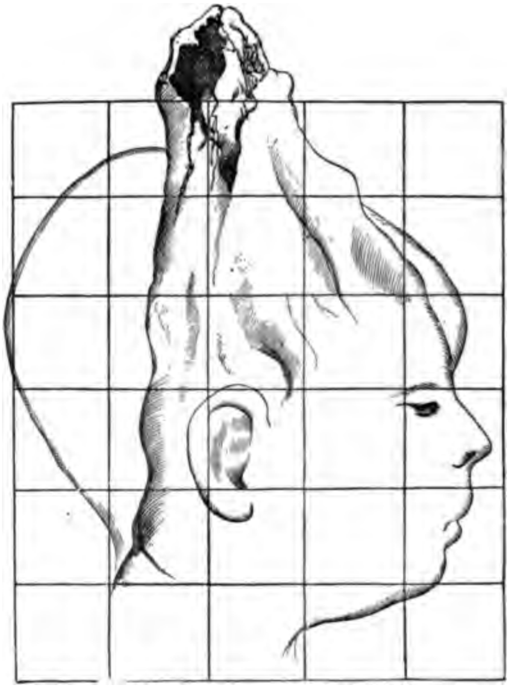
Craniotomy with Martin's Trephine.

Among the advantages to which the cranioclast of Braun can lay claim are its small size; the fact that its blades are nearly covered by soft parts during extraction, as one is within the head and the other is buried in the scalp; the security of its grip, which can be varied if needed; its simplicity, which allows it to be readily cleaned; and its pelvic curve, which permits rotation of the evacuated head and advantageous traction. Experience has shown that during traction with Braun's cranioclast the head moulds itself by the pressure of the pelvic walls without injury to the maternal tissues, as the only point at which the cranium is pierced is turned toward the aperture of the birth-canal, and is continually under the direction of the operator. The left blade should be passed deeply to the base of the cranium, while the right should grasp that opposite surface of the head which lies lowest in the pelvic axis.

After the delivery of the child and placenta an intra-uterine douche of hot thymol, 1 : 1000, or of bichloride of mercury, 1 : 5000, should be given. A uterine suppository containing from 30 to 60 grains of iodoform should be placed within the internal os. Any lacerations of the perineum should be carefully closed, superficial lesions of the vagina dusted with iodoform, and the regular administration of small doses of ergot, 15 to 30 drops of fluid extract every six hours, will often be found useful in favoring uterine involution.

Strict antisepsis is imperative in performing craniotomy, and if faithfully carried out the patient's convalescence is often speedy and uncomplicated. No further vaginal douches are needed, unless a positive indication, as foul lochia with fever, arises. Should the mother be very anæmic or there be reason to suspect the existence of nephritis, the intra-uterine and vaginal douches should not be of a mercurial solution, but of carbolic acid or thymol.

FIG. 62.



The Head after Delivery by the Cranioclast.

It may happen that the base of the cranium will not yield to the counter-pressure of the pelvic walls without the risk of injury to the maternal tissues. The use of the cephalotribe (cephalotripsy) is then indicated. This instrument is to be applied as is the forceps. Care must be taken that spiculæ of bone do not project at the aperture made by perforation to wound the maternal tissues. Especial caution should be exercised to apply the blades accurately to the head: enough of the hand should be inserted in the vagina, or a finger may be placed in the skull, to determine bony landmarks positively. The left hand should constantly ascertain and guide the position of the head during extraction. As in the use of the forceps, rotation of the head into its most favorable relation with the pelvis is best obtained by traction in the axis of the pelvis, the cranium elongating itself in the long axis of the cephalic portion of the blade of the instrument by the escape of its contents and the overlapping of the edges of the punctured bone at the point of perforation.

The cephalotribe is a more dangerous instrument to the mother than the cranioclast: with the instrument of Tarnier remarkably good results are reported by the French, to which reference will be made later. Perforation by the trephine, thorough evacuation of the cranium, and delivery by the cranioclast after Braun's method, as described, offer the least dangers to the mother in the larger proportion of craniotomies.

IN EXCEPTIONAL PRESENTATIONS OF THE HEAD.—In face presentations Auvard[1] advises perforating the forehead, and inserting one blade of the cranioclast in this aperture, the other in the mouth. Tarnier's simple basiotribe may be used as a trephine in these cases. When a suitable bony surface for trephining is not available, the simple perforator may be employed (Blot's, Naegele's). When bony landmarks cannot be recognized, perforation may be made at any convenient point. It is essential in these cases that the perforation be very deep; if through an orbit or the palatine region, the cavity of the cranium must be fairly opened, followed by thorough evacuation.

CRANIOTOMY ON THE AFTER-COMING HEAD.—Craniotomy is not indicated upon the after-coming head of the living child. An obstacle to delivery which cannot be overcome without craniotomy will soon cause the death of the fœtus. The operation is more difficult than in head presentations, because of the position of the head and the fact that the best localities for trephining are inaccessible. The trephine can very rarely be used in these cases, and the point of the perforator is liable to slip from the oblique direction at which it meets the head. The occipito-atlantoid ligament and the lateral fontanelles have been recommended as affording easy entrance to the perforator; but when the emergency arises no one anatomical landmark is selected, but the cranium is pierced as is most convenient under the existing circumstances. If the occiput be behind the pubes, the body may be raised and perforation made through the mouth or orbit. If the chin is anterior, the trunk may be held by an assistant and the base of the cranium entered. When the head is transverse in the pelvis, the trunk may be raised or lowered strongly and the region of the ear perforated.

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[1] *Thèse*, Paris, 1884.

The cephalotribe is occasionally used to extract the after-coming head without perforation. The head is favorably situated for the exercise of the crushing force of the instrument upon the base, and Lusk has found that the head accommodates itself readily to the pelvis. The traction made during delivery in breech presentations generally suffices to deliver the perforated head without difficulty: it sometimes happens that forceps modelled after the French instruments, which make strong compression, are found useful after the head has been perforated.

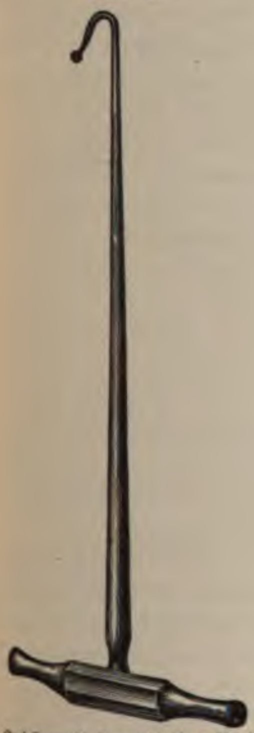
VERSION AND FORCEPS AFTER CRANIOTOMY.—Version after perforation has been strongly urged. If the head is emptied early in labor, and spiculæ of bone do not project from the aperture made by the perforator, version may be a safe and advantageous procedure. It is obviously not to be considered in delayed cases where uterine retraction has occurred and the inferior segment of the uterus is greatly distended. In the greater number of cases extraction with the cranioclast will be found a safer and less difficult procedure than version after craniotomy.

The application of the forceps to the perforated head is attended with decided risk. Accurate and firm apposition of the blades is rarely possible, as the form and size of the head change under the pressure of the instrument. The blades are very likely to slip unless the instrument be one capable of making very decided compression. As stated, it is occasionally advantageous to aid the delivery of the after-coming head with forceps when it is not readily delivered after craniotomy; but forceps should not be applied in head presentations when the cranium has been opened.

RESECTION OF THE HEAD.—Great ingenuity has been exercised in devising instruments for resecting the fœtal head in such a manner as to mechanically remove the resistance offered by the base of the cranium. Von Huevil and Tarnier have designed complicated forceps-saws by which a wedge whose larger end lies at the vertex, and whose narrow surface extends through the base, is removed. Barnes resects the head successfully with the wire écraseur. The Lollini in Bologna, Guyon, and Hubert have invented instruments for piercing the base and resecting the head. In the hands of their inventors these appliances have rendered good service, but they are rarely accessible to the average operator, who would not readily comprehend their use.

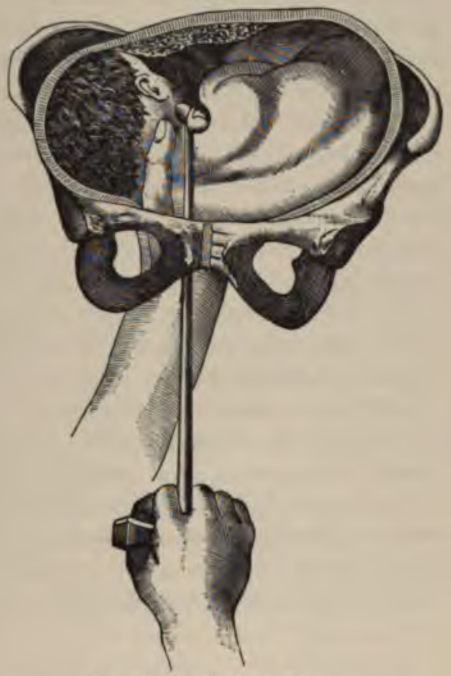
RESECTION OF THE FŒTAL TRUNK.—In contracted pelves when the fœtus has become impacted, in neglected shoulder presentations, and in monstrosities it may become necessary to resect the trunk of the fœtus. Decapitation is the most commonly performed of these resections. For this purpose the decapitation hook of Carl Braun is often employed. It consists of a rod tapering to the hook, which forms an acute angle with the rod and is tipped by a slight enlargement. The handle, at right angles to the rod, is sufficiently large to afford a firm grasp. To perform decapitation with Braun's hook the fingers of one hand should encircle the neck, while the hook should be guided to grasp the neck just below the fingers of the hand inserted. Downward tractions with rotary motions will rapidly sever the attachment of the head to the body. As the spinal column is felt to yield caution should be exercised, lest the hook leave its position suddenly and injure the maternal tissues.

FIG. 63.



Carl Braun's Decapitation Hook.

FIG. 64.



Decapitation by the Hook.

Blunt-pointed scissors may often be used to advantage in completing the division of the fasciæ and skin.

The chain saw has been passed around the neck by various devices: Tarnier and Thomas have devised complicated instruments for resecting the trunk by this means. A strong cord may be used, a catheter and stylet serving as guides in application. The use of a speculum is necessary in these cases to prevent injury to the vagina by the cutting of the cord. Pajot has fastened a lead ball to a strong cord and passed it about the neck by the blunt-hook commonly used in France: the weight of the ball brings the cord to the operator's grasp. Doléris[1] succeeded in decapitating a dead fœtus with ease by using a cord in the method devised by Pajot.

The head is commonly severed from the trunk by obstetricians not possessing instruments especially constructed for the purpose by bringing the neck as low as possible by traction upon the prolapsed part: the left hand is then used as a guide, and strong, blunt-pointed scissors are used. The employment of the cord and speculum is a rapid and easy method when the cord can be passed. Braun's decapitation hook performs its work with an ease and rapidity which are sometimes surprising. Resection of the fœtal trunk at some point other than the neck may be accomplished by strong scissors: it is usually combined with the evacuation of one of the cavities of the trunk or evisceration. The purpose of this procedure is to fold the body upon itself and permit version or spontaneous evolution of impacted shoulder presentations. Blunt-pointed scissors or the perforator may be employed to open the cavity entered; projecting bone should then be carefully removed, and the cranioclast or blunt-hook may complete delivery. When the position of the fœtus permits it, and it is macerated, destruction and removal of the macerated viscera, if decomposition be advanced, may be advantageously accomplished by the injecting apparatus used in craniotomy, an antiseptic solution of decided strength being employed. A single thorough intra-uterine antiseptic douche and an iodoform suppository should be employed after the extraction of the fœtus.

Various complicated instruments have been invented for performing embryotomy, but their use has generally been limited to their inventors. The surgical principle that the simplest instrument is the best is very clearly applicable to these as well as to other obstetric instruments.

THE INDICATIONS FOR AND LIMITATIONS OF EMBRYOTOMY AT PRESENT.

In rightly defining the position of embryotomy as an obstetric operation at present, the matter must be viewed as impartially as possible. Sentiment, so often a hindrance to clear thinking, should be disregarded. The effort to brand a procedure as murderous which has received the practical approval of many of the most intelligent obstetricians of the time is certainly an error. On the other hand, a misconception of the powers of nature, and a practical ignorance of those precautions which render the minor obstetric operations safe to mother and child, which have led some too early to resort to embryotomy, are an equally serious error. There remains, however, a middle ground of judgment, based on the study of the anatomy and pathology of the parturient uterus, and embracing a consideration of modern operations, which enables the obstetrician to meet more intelligently than formerly the responsibilities which complicated labor entails upon him. The discussion of the propriety of embryotomy may be simplified by considering first the performance of embryotomy upon the dead fœtus, and second upon the living fœtus: the existence or non-existence of pelvic disproportion will be considered under each division of the subject.

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[1] *Annales de Gynécologie*, March, 1885.

Embryotomy upon the Dead Fœtus.—The obstetrician is not infrequently summoned to cases of delayed labor in which the fœtus has perished. Examination of the patient may reveal a pelvis normal in proportions; the fœtus in head presentation; the amniotic fluid escaped; and the uterus in a condition of contraction and retraction known as uterine tetanus.[1] The dangers which threaten are rupture of the uterus, septic infection, and exhaustion. The lower uterine segment is greatly distended by the presenting part; the superior segment is firmly retracted, and has ceased to exercise an expellent force; and pressure upon the uterine tissues is causing stasis, engorgement, and a condition inviting infection. The indication is prompt emptying of the uterus with the least danger to the mother.

The first procedure which suggests itself to the mind of the attendant is the application of forceps. If the forceps were capable of lessening the size of the fœtal head sufficiently to relieve essentially the pressure upon the uterine tissues, its use would not be an added source of danger. But we fail to find satisfactory evidence that the forceps lessens symmetrically the size of the fœtal head beyond a slight degree: the reduction of one diameter to any considerable extent is followed by an increase in another, and the danger to the over-distended uterine tissues would remain the same. The forcible extraction of the head through the over-distended lower uterine segment and cervix would add to the dangers for the mother already existing. In primiparæ, in whom the strength of the lower uterine segment is greater than in multiparæ, the danger of extracting the head before reducing its size would be less than in multiparæ; in either, extraction without reduction of size is dangerous. Version is even more dangerous when uterine tetanus is fully established. As the child has perished, there is no sufficient reason why the size of the head should not be reduced and labor speedily terminated. In the greater number of cases perforation, evacuation, and extraction with the cranioclast furnish the safest method of delivery. Should excessive rigidity of the head at the base exist, the basilyst, basiotribe, or cephalotribe may be employed.

Under strict antiseptic precautions the rate of mortality from craniotomy in these cases is very low. Traction by the cranioclast is made in the axis of the pelvis; if the trephine is used, no projecting spiculæ of bone endanger the maternal tissues; the thorough evacuation of the head allows it to mould readily to the pelvis, and the use of antiseptics reduces the danger of infection to a minimum. Merkel,[1] in 100 craniotomies, performed 6 when the pelvis was normal in proportions and the child had died. Thorn[2] in 80 craniotomies performed 14 in normal pelves when the fœtus presented by the head or breech and had died, with a mortality of *nil:* in these cases no deformity of the fœtus existed, but disproportion between the size of the fœtus and pelvis was in some cases present. In private practice the natural repugnance to any procedure which resects the fœtus would at first result in objection to the performance of craniotomy in these cases; but if it be understood that the fœtus is dead and that the mother's life is in danger, this objection will be commonly withdrawn. The mother should invariably be anæsthetized. Where uterine tetanus exists, chloroform is preferred by Continental obstetricians, because it favors relaxation of the rigid uterine tissue. The skilful administration of chloroform in these cases has repeatedly proved advantageous, and is to be commended for more extensive use by American obstetricians. If strict antisepsis be observed at the operation, complications during the puerperal period will be reduced to a minimum.

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[1] Schroeder: *Lehrbuch der Geburtshülfe.*

In neglected shoulder presentations in normal pelves, when the child is dead and a tetanic condition of the uterine muscle has supervened, embryotomy is indicated. The choice of the mode of decapitation will be decided by the resources and training of the operator: resection of the trunk, other than decapitation, may be performed as circumstances will best permit. The diameters of the after-coming head of the dead fœtus may require reduction in normal pelves; the cephalotribe has been found especially efficacious for this purpose, for reasons which will be stated presently.

In contracted pelves, after the death of the fœtus, the indications for embryotomy are more universally recognized. If the degree of pelvic contracture be slight and the head presents, compression by the cephalotribe may effect delivery, with traction in the axis of the pelvis, without difficulty. The necessity for perforation may occasionally be obviated by the use of the cephalotribe in these cases, as has been advised by Lusk. Notwithstanding the fact that, as a rule, a considerable degree of compression upon the fœtal skull in one diameter is followed by an increase in the size of another, the cephalotribe, when applied in the antero-posterior diameter of the head, is capable of lessening slightly that diameter with but a slight increase in one of the others. Murray[3] has found by experiment that the fœtal skull is compressible in an antero-posterior direction by the sliding of the occipital and frontal bones under the ends of the parietal bones: such compression produces no appreciable enlargement in the transverse diameters; compensation is effected by vertical elongation of the skull, which provides for the accommodation of the cranial contents. Application of the compressing instrument in any but the antero-posterior diameter of the head is, however, followed by corresponding elongation of the opposite free diameter. In cases of slight pelvic contraction it may therefore be advantageous to apply the cephalotribe in the antero-posterior diameter of the head, elongate the head vertically, and deliver it by traction in the axis of the pelvis: as the fœtus is dead, no thought need be given to the effect produced upon its brain by compression of the head. In slightly-contracted pelves the use of the cephalotribe upon the after-coming head, when applied in the manner recommended by Lusk and Murray, is an expedient well worthy to be kept in mind.

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[1] *Archiv für Gynäkologie*, Band xxi. p. 461.

[2] *Ibid.*, Band xxiv. Heft 3, 1884.

[3] *Edinburgh Medical Journal*, November, 1888.

In contracted pelves the death of the fœtus ordinarily occurs earlier in labor than in normal pelves, because of the failure of the presenting part to descend and vigorous compression of the fœtus early in labor before the expulsive segment of the uterus has become exhausted. In a case of slightly contracted pelvis seen immediately after the death of the fœtus, and before a tetanic condition of the uterine muscle and great distension of the inferior segment had supervened, less complete reduction of the diameters of the head would be necessary than in a case in which the pelvis was normal and the lower uterine segment was distended almost to the point of rupture. As a rule, perforation, evacuation, and delivery by the cranioclast in head presentations is safest in these cases, in normal and contracted pelves: occasionally, before uterine tetanus has developed with over-distension of the inferior segment, the use of the cephalotribe without perforation is permissible.

In markedly contracted pelves, when the fœtus is dead, embryotomy is indicated. Should the conditions present have endured so long that necrosis of maternal tissues and maceration of the fœtus, with tissue disorganization, exist, with beginning septicæmia, the extirpation of fœtus and uterus by supravaginal amputation is to be advised. The presence of multiple fibromata complicating parturition greatly increases the danger of septicæmia from necrosis of the uterine tissues, and renders the prognosis after Cæsarean section extraordinarily grave if the uterine incision passes through a fibroid, as necrosis of the tumor follows. In multiple fibromata with death of the fœtus, if symptoms of extensive tissue-necrosis be present, extirpation and drainage are indicated.[1] Embryotomy under such circumstances would result in lacerating tissues already disorganized, and causing fresh absorption of septic virus.

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[1] See cases of fibromata complicating pregnancy and parturition, reported by Porak, *Bulletin de la Société Obstétricale*, No. 4, 1888; also Cæsarean section, death from sepsis

Embryotomy upon Fœtal Monstrosities.—In the case of fœtal monstrosities the mother's interests are so manifestly paramount that the propriety of performing embryotomy cannot be questioned when Nature's efforts fail in delivery. As the presentations of monsters are anomalous, no rule can be given for the performance of the operation save that of expediency, circumstances deciding the particular procedure to be adopted. Craniotomy in hydrocephalus is best performed with a trocar and canula, as the evacuation of a portion of the fluid within the skull is not necessarily fatal to the fœtus, and often permits labor to terminate normally. Schroeder's suggestion, to perform version after partially evacuating the skull, is appropriate when the conditions favorable for version exist. When version is impossible and Nature fails to deliver the head after partial evacuation, perforation, complete evacuation of the head, and delivery by the cranioclast are indicated. While the life of the hydrocephalic fœtus should not be thoughtlessly sacrificed, it cannot be held of equal value with the normal child, and its existence should not be allowed to jeopardize the mother's.

Embryotomy upon the Living Fœtus.

Embryotomy upon the living fœtus may be considered by the obstetrician—1. When the dimensions of the pelvis are normal; 2. When the pelvis is abnormally small.

When the pelvis is normal an abnormality in the mechanism of labor may produce conditions in which embryotomy upon the living fœtus has been advised. Such conditions are a malrotation of the head, the chin turning into the concavity of the sacrum or the occiput turning posteriorly. Failure of the head to engage and shoulder presentation persisting to the point of uterine retraction and tetanus of the uterine muscle may also suggest the performance of embryotomy. Impaction of the after-coming head and the locking of twins may raise the question of embryotomy before the death of the fœtus. An abnormal condition of the mother's soft parts may seem to indicate a destructive operation on the living fœtus: rigidity, cicatricial contraction, tumors, and congenital malformations occurring in these tissues may render the delivery of a living child through the birth-canal impossible. The destruction of an abnormally large and living fœtus has been frequently practised when no pelvic contraction existed.

In contracted pelves experience with the majority of obste-

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in this condition (Baily, *Lancet*, May 12, 1888), and successful Cæsarean section when fibromata were present (Jay, "Cæsarean Section with Oöphorectomy," *Amer. Jour. Med. Sci.*, November, 1888).

tricians has fixed 3 inches as the antero-posterior diameter through which a living child of normal proportions may pass: the French, who are especially skilled in axis traction, report the greater number of successful deliveries by forceps at or above 3 inches in the antero-posterior diameter of the inlet.[1] Regarding the antero-posterior diameter which permits the extraction of the trunk of the fœtus after embryotomy, the limits vary with the instrument employed and with the dexterity of the operator. And here, again, the French, who have given especial attention to the construction of instruments for the destructive operations, speaking from large experience, fix 2⅝ inches as the limit of delivery for the fœtal body by traction after embryotomy.

But no exact measurement can be adopted as a basis of judgment, nor can fractions of an inch determine the choice of a given operation. Choice must be made upon relative size and proportions of fœtus and maternal pelvis, and a rational judgment can be formed on these grounds only.

The means at present known for ascertaining the size of the fœtal head *in utero* yield comparative information only, and consist in the attempt to fit the head into the pelvis by suprapubic pressure. Our present knowledge regarding the inferior segment of the uterus, and the importance of recognizing its over-distension in complicated labors, add an important factor in estimating the need for a radical operation whether conservative or destructive. Disproportion of fœtus and pelvis, and the condition of the mother both as regards her general strength and freedom from infection and with reference to the physiological or pathological condition of her genital tract,—these furnish to-day the basis of a rational judgment: a given pelvic measurement is useful as an indication of what has been the experience of others under similar circumstances, but is not a final ground for decision.

Granting the existence of a labor which cannot be terminated without lessening the proportions of the child to a fatal extent or injuring the mother's birth-canal in probably a fatal manner, a radical obstetric operation is demanded in the management of the case, whether the treatment be prophylactic or curative. The prophylactic treatment of this condition lies in the induction of labor. The cautious obstetrician will obtain warning of an existing abnormality in the maternal pelvis or fœtus by the history of a former labor if one has occurred: if the patient be a primipara, he should examine her from four to six weeks before her expected labor, satisfy himself of the proportionate size of fœtus and pelvis, diagnosticate the fœtal position and, if possible, the presentation, and be assured that no marked pelvic contraction exists. Pelvimetry may be so performed by one accustomed to examine the pelvis that the delicacy of a patient will not be offended; prudery on her part, and hesitation excusing neglect on the part of her attendant, are to be disregarded alike.

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[1] See the report of 29 cases by Varnier (*Gazette Hébdomadaire*, No. 47, 1888).

Under antiseptic treatment and modern methods of nourishing premature children much greater encouragement can be held out to a mother to submit to the induction of labor than formerly. Wyder[1] has collected 306 cases of induced labor—maternal mortality of 3.9 per cent.; Strauch[2] reports 26 cases, with maternal mortality *nil;* Korn,[3] 45 cases—maternal mortality 2.2 per cent.; Winckel, Sabarth, Hecker, Spiegelberg, Haidlen, and Fehling have collected statistics showing maternal mortality of *nil.* The fœtal mortality of induced labor Strauch found to be 55 per cent. in his cases; Caruso,[4] averaging a large number of cases, estimates it at 39 per cent., and expects an improvement in this result by improved methods.

Induced labor under antiseptic precautions offers but little danger to the mother and a very considerable risk to the child. In the case of children with sound parentage, in good homes, and under skilful treatment this risk would be greatly lessened. The results of inducing labor are sufficiently good, on the side of the mother, to demand careful consideration for this procedure as prophylactic treatment in avoiding the dangers of complicated labor. That the chances for the child are not desperate is shown by the reports of Credé and Tarnier. The former[5] lost but 18 per cent. of 678 premature children; the latter,[6] 30 per cent. of 151 poorly-developed premature infants.

If the time for induced labor be past, the first operation in point of antiquity and usage demanding consideration is embryotomy, and generally craniotomy. In regarding this operation favorably the life of the fœtus is of course disregarded. The chance of life and subsequent health for the mother is an excellent one under modern antisepsis. Before the antiseptic era obstetricians reported a maternal mortality from craniotomy of from 38.52 per cent. (Rigaud and Stanesco) to 11.8 per cent. (Müller). The mortality of craniotomy at present, by the most experienced operators, has been greatly reduced. Thus, Spiegelberg[7] reports 58 craniotomies with 10 per cent. maternal mortality; Wyder,[8] 215, mortality 5.6 per cent.; Merkel,[9] 100, with 4.7 per cent. death-rate; Olshausen,[10] mortality-rate, 8.7 per cent.; Winckel,[11] 13.3 per cent.; Rokitansky,[12] 52 successful cases; Jaggard,[13]

[1] *Archiv für Gynäkologie*, Band xxxii. Heft 1.

[2] *Ibid.*, Band xxxi. Heft 3.

[3] Leopold: *Der Kaiserschnitt, etc.*, Stuttgart, 1888.

[4] *Archiv für Gynäkologie*, Band xxxiii. Heft 2.

[5] *Ibid.*, Band xxiv. S. 128.

[6] Reported by Auvard, *Archives de Tocologie*, 1883, p. 577.

[7] *Lehrbuch der Geburtshülfe*, 1882, p. 756.

[8] *Op. cit.*

[9] *Archiv für Gynäkologie*, Band xxi. S. 461.

[10] *Ibid.*, Band xxiv. S. 438.

[11] *Lehrbuch der Geburtshülfe*, Leipzig, 1888, SS. 658–712.

[12] *Lehrbuch d. g. Gynäkologie*, p. 789.

[13] *Amer. Journ. Obst.*, 1884, p. 1132.

82 cases in Carl Braun's wards, mortality 7 per cent.; Präger,[1] 71 cases, maternal mortality-rate *nil* from sepsis, 1.4 per cent. from other causes; Determann,[2] 239 craniotomies, mortality from 12.8 to 9.4 per cent. These operations were, in the majority of cases, perforation and evacuation, with the use of the cranioclast or cephalotribe to complete delivery.

The French operation of cephalotripsy or basiotripsy, as done with instruments of French invention, affords excellent results so far as the mother is concerned. Pinard[3] has collected 49 basiotripsies by 7 operators, with maternal mortality *nil;* Bar[4] reports 3 favorable cases; Wasseige,[5] 35 cephalotripsies, mortality 6 per cent.; Pajot[6] performed 8 cephalotripsies in greatly-contracted pelves, with 6 recoveries. Potocki,[7] in 19 cases of resection of the fœtal trunk by Tarnier's embryotome, reports a mortality of 6, 1 of which was imputed to the instrument. It is evident that embryotomy under antiseptic precautions offers to the mother an excellent chance for recovery and subsequent comfortable health. Thus, Caruso[8] averages the results of 364 craniotomies, resulting in $6\frac{6}{10}$ per cent. mortality; $93\frac{4}{10}$ of the mothers recovered.

Regarding the frequency of embryotomy, Merkel,[9] in analyzing 100 cases, found 1 craniotomy in 56 births; this, as Credé[10] remarks, is among a poor population, living in extremely unsanitary conditions. Thorn, reporting Olshausen's cases,[11] estimated 1 craniotomy to $89\frac{1}{2}$ births where sanitary conditions of life had been better. Both series of cases extended over a long term of years, beginning before the introduction of antisepsis or the perfection of induced labor and pelvimetry.

A better basis for estimating the frequency of embryotomy at present is afforded by statistics of more recent periods. In the clinic in the Vienna General Hospital, now in charge of Breisky, during 1885, 2761 births occurred; 19 craniotomies and 1 decapitation were performed, or 1 destructive operation in 138 labors.[12] At Marburg, during 1887, Ahlfeld's[13] confinements numbered 308, without a destructive operation. At the Philadelphia Hospital 188 births occurred in 1887,[14] without a destructive operation; at the Boston Lying-in Hospital, in 112 births during three months in 1888, 3 craniotomies were performed.[1]

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[1] Leopold: *Der Kaiserschnitt, etc.*, Stuttgart, 1888.

[2] *Zeitschrift für Geburtshülfe und Gynäkologie*, Band xv. Heft 2.

[3] *Archives de Tocologie*, August 30, 1887.

[4] *Le Progrès médical*, Nos. 51 and 52, 1884.

[5] *Des Operations obstetricals*, Paris, 1881.

[6] Charpentier: *Traité pratique des Accouchements*, tome ii. p. 750.

[7] *Thèse*, Paris, 1888. [8] *Op. cit.* [9] *Op. cit.*

[10] *Archiv für Gynäkologie*, Band xxiv. Heft 3. [11] *Op. cit*

[12] For permission to publish the records of the clinic the writer is indebted to Dr. Ludwig Piscaçek, first clinical assistant.

[13] *Deutsch. med. Wochenschrift*, Nos. 23-28, 1888.

[14] *Report Dept. Charities and Correction.*

The tendency has been to diminish the frequency of destructive operations as knowledge has become more complete regarding conservative measures. As serious pelvic contraction is rare in American-born women, so the destructive operations are not often performed among them. Could extensive statistics of embryotomy in private practice be obtained, it would be shown to be done less frequently than in maternities. Potocki[2] has found that 32,938 confinements furnished 151 shoulder presentations in hospital practice, of which about one quarter became so impacted as to require resection of the fœtal trunk. This happened from no fault of the staffs of the hospitals, but from the carelessness or ignorance of the midwives and physicians of towns and villages, who neglected to perform version promptly.

If the conditions for which destructive operations are most frequently performed be considered, Merkel in his 100 cases collected 46 performed for disproportion between fœtus and pelvic canal occasioned by flattening of the pelvis; 36 because of symmetrically-contracted pelvis; 6 when the pelvis was normal. Thorn in 80 operations found 16 normal pelves, but disproportion between fœtus and pelvis in 80 per cent. Regarding the destructive operations from the standpoint of the treatment of contracted pelvis, Winter[3] has collected the results of various modes of treatment in 632 contracted pelves in which craniotomy was performed 97 times—1 in 6.5 cases. The forceps was used 98 times, while version ended labor 271 times. These results indicate that the deciding element in fixing the choice upon a destructive operation was not a pelvic contraction in itself, but disproportion between fœtus and pelvis: certain grades of disproportion were safely overcome by nature, by version and forceps, while in but a small number of cases was a destructive procedure employed. A further illustration of this distinction is found in the fact that both Winter and Thorn performed one-fifth of their craniotomies upon the after-coming head.

In estimating the indications for a destructive operation the obstetrician should not lose sight of the fact that it is not a contracted pelvis which will necessitate a destructive operation, but such disproportion between the type and development of fœtus and pelvis as to defeat Nature's efforts at delivery, aided by the conservative resources of the obstetric art. It is an interesting and even curious fact that as the degree of disproportion between fœtus and pelvis becomes pronounced the mortality of the destructive operations is lessened. Thus, Wyder[4] found a maternal mortality of 15 per cent. when craniotomy was performed in pelves whose antero-posterior diameter at the inlet was 3½ + inches; from 2¾ to 3½ inches, 10 per cent.; from 2⅛ to 2¾ inches, mortality *nil.* The explanation may be found in futile efforts at delivery with forceps by the obstetrician, resulting from failure to correctly estimate the existing disproportion between fœtus and mother and the physiological or pathological conditions present. As the disproportion became more evident the patient was spared these injurious and futile endeavors.

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[1] Boardman: *Boston Med. and Surg. Journal*, No. 9, 1888.

[2] *Op. cit.*

[3] *Zeitschrift für Geburtsh. und Gynäk.*, Band xxxi., 1886.

[4] *Op. cit.*

To summarize the discussion of the choice of embryotomy (generally craniotomy) upon the living fœtus, it may be said that the importance of a prophylactic scrutiny of the pregnant woman from four to six weeks before labor must be strongly urged: a previous successful pregnancy and parturition throws the bulk of evidence in favor of a second similar labor, provided the paternity and general conditions be the same. A practical estimate of the comparative type and development of mother and fœtus is afforded by palpation and auscultation, by the adaptation of the presenting part to the pelvic canal by suprapubic pressure and by pelvimetry. Should decided disproportion be diagnosticated, the induction of labor under antiseptic precautions is attended by a minimum risk to the mother; fœtal mortality, with competent after-treatment, varies from 18 to 39 per cent. Should decided disproportion between fœtus and mother not be diagnosticated or neglected, and labor occur, or should dystocia become absolute through failure in the mechanism or dynamics of parturition, the obstetrician may terminate labor by embryotomy with an average maternal mortality of 6.6 per cent. under antiseptic precautions, but with the inevitable death of the fœtus. For the discussion of the indications for the use of forceps the reader is referred to previous pages upon that subject: briefly, the engagement and moulding of the head at the superior strait of the pelvis, in a primipara of average strength and not infected by sepsis, furnishes an indication for forceps. Regarding version, the fact that the head is not excessively large or unusually ossified, as ascertained by palpation and vaginal touch; the multiparity of the mother; freedom from over-distension in the lower uterine segment, with absence of tetanus of the uterine muscle and septic infection,—are indications for this procedure.

Excluding induced labor, forceps, and version as inappropriate, there remain for comparison with the results of embryotomy those afforded by modern Cæsarean section, laparo-elytrotomy, amputation of the pregnant uterus, and symphysiotomy.

The maternal mortality of the first 50 cases of the modern Cæsarean section performed in continental Europe was estimated at from 20[1] to

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[1] Harris: *The Medical News*, 1887, p. 686.

17.9[1] per cent. on the part of the mothers, and 2 per cent. of the children. The revival of the operation in the United States was followed by 11 operations, with maternal mortality $45\frac{5}{11}$ per cent., and fœtal mortality $27\frac{3}{11}$ per cent.[2] Within a short time the list of successful cases has been increased, improving the statistics of American operations.[3]

The status of the operation among German operators has been described by Leopold in a recent work.[4] The maternal mortality under the improved operation at his clinic in Dresden during the past four years has been 8.6 per cent.—4.3 per cent. from sepsis; fœtal mortality was 13 per cent. These operations were performed largely for pelvic contraction. Caruso[5] tabulates 135 cases to October 1, 1888, with maternal mortality $25\frac{56}{100}$ per cent., including the first 50 reported in Europe; fœtal mortality, 8.27 per cent. In cases of repeated Cæsarean section the mortality was *nil.* It is interesting among the operators of all civilized nations whose results are tabulated by Caruso to notice that, after Germans, Americans have operated most frequently. When it is considered that Leopold leads German operators in the number of his Cæsarean sections, his results may be taken as a fair index of the chances of the operation under the best conditions: the results reported by Caruso are not an optimistic estimate of this procedure, but the results obtained by a miscellaneous collection of obstetricians. It is probably a fair conclusion to estimate these figures—8.6 per cent. and 25.5 per cent. mortality among mothers—as representing the range of the modern operation. Fœtal mortality varies from 13 to 8.27 per cent.[6]

The operation of gastro-elytrotomy may be regarded as an expedient, but not as a hopeful resort, in difficult labor. Clarke[7] and McKim[8] report 14 cases, to which Caruso adds 4, in the literature of the subject, aggregating 18. The latter very properly disregards the 4 cases in estimating the results, as the operations were performed before modern surgical methods were known; the remaining 14 give a maternal mortality of 50 per cent. and a fœtal mortality of 42.8 per cent. This operation cannot be regarded as anything but a doubtful resource, to be employed only in the failure of better means of completing labor.

Symphysiotomy as practised by the Italian school of obstetrics gives results comparing favorably with those of the modern Cæsarean operation. Harris' statement of 50 Neapolitan cases[1] shows a maternal mortality of 25 per cent. and fœtal mortality of 18 per cent. This operation has been hitherto confined to the Italian and French schools, and has not been practised in Germany or America to any great extent. It is to be regarded as a practicable and rational means of effecting delivery in contracted pelves, but not readily available to Americans because of the lack of experience with the operation among American obstetricians. At the present time the indications for symphysiotomy are set forth by Morisani[2] as follows: 2.6 inches is the shortest true conjugate at which the operation is justified; the gain in the antero-posterior diameter of the pelvic inlet is .85 to .97 of an inch by the operation, which is permissible when the antero-posterior pelvic measurement is 3.12 inches and forceps and version are contraindicated.

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[1] Wyder: *op. cit.*

[2] Harris: *Medical News*, 1888, p. 350.

[3] See the cases of Jaggard (*Medical News*, 1888, p. 405), Kelly, *ibid.*, Sept. 22, 1888, p. 320, and Jay (*Amer. Journ. Med. Sci.*, November, 1888, p. 465).

[4] *Der Kaiserschnitt und Seine Stellung zur Künstlichen Frühgeburt, Wendung und Perforation bei Engem Becken*, Stuttgart, Enke, 1888.

[5] *Archiv für Gynäkologie*, Band xxxiii. Heft 2, S. 211.

[6] Harris (*Medical News*, Dec. 15, 1888, p. 678) has collected 149 Cæsarean operations; al mortality, 27½ per cent.

ncy, 1887.

[8] *New York Med. Journ.*, 1887, p. 651.

Amputation of the pregnant uterus (Porro's or the Porro-Müller operation) is not to be regarded as a rival to the modern Cæsarean section, but as indicated in conditions which the more conservative operation cannot meet. The indications for amputation of the pregnant uterus are set forth by Leopold[3] as follows: Infection of the body of the uterus; stenosis of cervix and vagina by tumors not connected with the uterus; uterine myomata; pregnancy in an occluded uterus bicornis; in ruptured uterus in contracted pelves; in retained placenta, with sepsis; in osteomalacia. Tait[4] has recently published his method of operating in 3 successful cases, in which the technical difficulties of the operation were greatly reduced.[5] Porro, Breisky, and others have shown that the results of this operation are such as to cause it to be regarded as a complement to the modern Cæsarean section in conditions where the removal of the body of the uterus is indicated to save the mother's life or prevent subsequent conception. For purposes of comparison with embryotomy it may be considered together with the Cæsarean section.

For the American obstetrician, when the time for prophylaxis is past, and a living fœtus cannot be delivered by version or forceps, there remains practically the choice of a radically destructive or a radically conservative procedure—embryotomy or uterine section, whether so-called Cæsarean section or amputation. No subject in the range of obstetric science has occasioned keener discussion than this. With the introduction of antiseptics both operations have shown greatly improved results. The constant improvement in the details of surgical procedures, and Sänger's vitally important modifications in closing the uterine wound and preventing hemorrhage, have brought the radically conservative procedure to a stage of efficiency where its claims cannot be disregarded.[1] The question naturally arises, Upon what grounds may the obstetrician feel personally justified in advising his patient to submit to the Cæsarean section or uterine amputation? As all medical and surgical service is rendered under a moral and legal contract by virtue of which the physician guarantees competent knowledge and skill, the degree of especial dexterity requisite for this operation is a point of interest. The researches of Harris, Caruso's collection of cases, and a study of recent successful operations lead to the belief that a theoretical and practical knowledge of the cardinal axioms of surgery as practised to-day is requisite. Thus, Hofmeier[2] considers the essentials of success to be scrupulous antisepsis, early operation, sufficient uterine sutures. Leopold[3] holds it as essential that operator and assistant understand antisepsis and the plan of operation.

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[1] *Amer. Journ. Med. Sci.*, 1883, p. 25.

[2] *Proceedings Italian Obstetrical and Gyn. Soc.*, Sept. 3, 1888.

[3] *Op. cit.*

[4] *British Medical Journal*, Nov. 17, 1888, p. 1100.

[5] Harris (*Med. News*, Dec. 15, 1888, p. 678) has collected 232 Porro operations—mortality, $47\frac{3}{10}$ per cent.

As the tendency of modern surgery is to simplicity in operating, no matter how minute the precautions for avoiding septic infection may be, so the Cæsarean operation requires few instruments and but average technical skill. Intelligent judgment regarding the time for operating, a thorough observance of antisepsis, and the co-operation of several intelligent assistants are demanded. These conditions on the part of the obstetrician are not difficult to fulfil. For the performance of embryotomy a knowledge and observance of antiseptic precautions are requisite equal to those demanded for Cæsarean section. The technical skill needed to perform a difficult embryotomy is fully as great as, if not greater than, that which the Cæsarean operation calls into play, while the instruments employed for the destructive operation are more complicated than the simple surgical appliances needed in the conservative procedure.

Inasmuch as the chances for the mother's life are not yet equally good under embryotomy and uterine section, the absolutely essential condition of the latter must be the consent of the mother or her friends. This is insisted upon by Leopold[4] and Caruso,[5] and has been frequently exemplified in practice. Equally important is the mother's condition. She must not be exhausted and in the beginning of labor; she must be free from septic infection and from severe injury from previous efforts at delivery. On the side of the fœtus heart-sounds must be normal in strength and frequency (Leopold). When these conditions obtain and the obstetrician feels personally justified in assuming the responsibility of an operation, the mother's chances for life and recovery may be stated as follows: With the sacrifice of her child *at least* nine chances out of ten for her own recovery; with the modern Cæsarean section her chance for life ranges from three in four to nine in ten,[1] while her infant has nine chances in ten for life.

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[1] For controversial literature on this point see Montgomery, *Medical Times*, 1888, p. 387; Busey, *Amer. Journ. Obst.*, 1884, p. 178; Jaggard, *ibid.*, p. 1132; Meadows, Tait, and Barnes, *British Gynecological Journ.*, 1886–87, vol. ii. p. 308; and Lébédeff, *Archiv f. Gynäkol.*, 1887–88, Band xxxi. p. 218.

[2] *Zeitschrift für Geburtshülfe und Gyn.*, Band xiv. Heft 1.

[3] *Op. cit.*

[4] *Op. cit.*

[5] *Op. cit.*

That the outlook for the Cæsarean operation in the United States will improve there can be no doubt; at present American operators have not equalled those of Germany, who are are far in advance of all others. The obstetrician cannot discharge his full duty to his patient and her unborn child in the dangerous complications of parturition which call for radical treatment without stating to her friends and to herself the conditions of that choice which modern science affords her. These conditions are of too recent origin for the popular intelligence to have apprehended them, but the obstetrician, whose duty it is to give his patients the benefit of the most recent knowledge, cannot escape the obligation which they entail upon him.

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[1] Estimates of Caruso and Harris, the operation having been done under favorable conditions.

THE PREMATURE INDUCTION OF LABOR.

By JAMES C. CAMERON, M. D.,

MONTREAL.

By "the premature induction of labor" is meant the artificial arrest of gestation in the interests of the mother or child, or both. If the fœtus is viable, the operation is called "induction of premature labor;" if not viable, it is called "induction of abortion." As fœtal viability is usually reckoned from the end of the seventh month, that date may be considered the dividing-line between the two operations. Artificial *abortion* aims to save the mother at the expense of the child; artificial *premature labor*, to save both if possible, or the child at least if the mother's death is inevitable.

HISTORICAL NOTE.—Abortion is one of the oldest obstetric operations, having been practised more or less from very early times. Among the ancients the fœtus *in utero* was looked upon as part of the mother's body,[1] and among some nations its destruction was not only allowed, but even sanctioned, as a means of improving the race or keeping down surplus population. Although at times the value of the operation as a therapeutic measure seemed to be dimly recognized, it is nevertheless quite plain that up to the Christian era its scope was upon the whole destructive rather than conservative. But from the very first the Christian Church upheld the rights of the unborn child and put abortion on a par with infanticide.[2] As Christianity spread over Europe the practice of abortion gradually died out, till at last it survived only among the Arabians as an expedient in deformity of the pelvis. Justine Siegmundin (1690), Puzos (1707), and Bohn (1717) advised the induction of premature labor by puncturing the membranes in cases of placenta prævia. In England it was first used by Cooper (1717) as an alternative to Cæsarean section. But whatever credit may be due elsewhere for suggestions and recommendations, to English obstetricians undoubtedly belongs the chief honor of recognizing the true value of the operation, defining its just limitations, and legitimizing it as a truly conservative resource. It had occasionally been observed that women with pelves too contracted to permit the birth of a living child at full term sometimes bore living children at the seventh or eighth month. It was proposed, therefore, to imitate nature in such cases and induce labor artificially, in the hope of saving the child and avoiding the horrors of craniotomy or the old Cæsarean section. The proposal aroused public and private interest to such an extent that finally, according to Denman, a meeting of eminent obstetricians was held in London (1756) " to consider the moral rectitude of, and the advantages which might be expected from, this practice." The warm indorsement of that influential meeting at once gave the operation a status in England. Shortly afterward it was performed successfully by Macaulay upon the wife of a London tradesman. Championed by such men as Denman, Marshall, and Ramsbotham, it soon became firmly established. From Great Britain it passed over to Germany, where it was proposed by Mai of Heidelberg (1799) and Weidmann, and first practised by Wenzel (1804). In 1818, Reisinger's monograph secured its general adoption. From Germany it extended to Holland, Italy, Denmark, Switzerland, and other countries. In France, where the power of the Church[1] was strong, it was long discountenanced as unjustifiable and even criminal. In 1779 it was proposed by Roussel de Vauzesmes, but defeated by the bitter opposition of Baudelocque and his school. In 1827 it was, through his influence, formally rejected by the Academy of Medicine. Its next champions were Foderé (1830) and Burckhardt, and the first successful French operator was Stoltz of Strassburg (1831). The powerful advocacy of Dubois, and later of Dezeimeris, Lacour, Ferniot, Lazare Sée, and others, finally succeeded in overcoming religious opposition and legitimizing it in France morally as well as legally.

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[1] Lecky says: "The general opinion among the ancients seems to have been that it was but a part of the mother, and that she had the same right to destroy it as to cauterize a tumor upon her body. Plato and Aristotle both admitted the practice. The Roman law contained no enactment against voluntary abortion till the time of Ulpian. The Stoics thought the infant received its soul when respiration began. The Justinian code fixed its animation at forty days after conception. In modern legislations it is treated as a distinct being from the moment of conception."—*History of European Morals*, vol. i. p. 92.

[2] Lecky's *History of European Morals*, vol. ii. pp. 24-34.

INDICATIONS FOR THE INDUCTION OF ABORTION.

The safety of the mother may require the arrest of gestation before the child becomes viable. The life of the fœtus is dependent upon that of the mother; if the mother is allowed to perish, the fœtus must perish with her. For the fœtus the result will be the same in grave cases, whether abortion be induced or not: it will perish in either event. But for the mother it is entirely a different matter: her life may be saved by the speedy arrest of gestation. Whenever such is the case interference is not only legitimate, but becomes actually imperative. In general terms, then, it may be said that the induction of abortion is justifiable (1) whenever there is such mechanical obstruction that the birth of a viable child is impossible; (2) whenever the mother is suffering from such grave disease that her life is in imminent peril and can be saved only by the arrest of gestation.

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[1] The dictum of the Roman Catholic Church was: "Si l'on ne peut tirer l'enfant sans le tuer, on ne peut sans péché mortel le tirer."

1. MECHANICAL OBSTRUCTION.—The most important forms are—

Pelvic Contraction.—When the conjugate of the brim is under 6 cm. (2.36 in.) the induction of abortion is indicated. The alternatives are craniotomy and Cæsarean section at a later period. Craniotomy somewhat increases the mother's risks, while it is no better for the child; the modern Cæsarean section gives the child a fair chance, but endangers the mother. In those rare cases where osteomalacia causes the pelvic contraction the softened bones may yield sufficiently to allow a viable child to pass. In such cases it is safe to wait for viability.

Tumors, pelvic, uterine, or ovarian, which block up the pelvis and mechanically impede the course of labor, if they cannot be displaced or removed.

Cicatricial contraction of cervix or vagina, if incapable of sufficient dilatation to allow the passage of a viable child.

Carcinoma of the uterus or vagina.

Certain displacements of the womb, rendered irreducible by firm adhesions to the surrounding parts, such as procidentia, retroflexion, or retroversion, particularly if there is any tendency to uræmic complication.

Fixation of the uterus by adhesions.

2. URGENT DISEASE COMPLICATING PREGNANCY, such as—

Vomiting which has resisted all other treatment, local and medicinal, especially if accompanied by progressive emaciation and a persistently high pulse. In such cases it is always wise to interfere in good time, before the patient's strength is too far spent.

Grave heart and lung troubles, with severe dyspnœa, such as aneurism, valvular disease, pleurisy, œdema, etc.

Pernicious anæmia, according to Breisky.

Hemorrhages which are exhausting the patient and do not yield to treatment.

Albuminuria,[1] with threatened eclampsia, and exceptionally *hydramnios*, *chorea*, *insanity*, *advancing jaundice* with diarrhœa, etc.

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[1] In the discussion on "Intra-uterine Death" at the Glasgow meeting of the British Medical Association (August, 1888), Dr. Barnes argued strongly in favor of inducing premature labor when marked albuminuria occurs in advanced pregnancy. He believes albuminuria to be a common cause of intra-uterine death, and thinks that interference in such cases will benefit both mother and child—the former by warding off eclampsia, the latter by preventing intra-uterine death.

Nature often shows us the rational treatment in such cases; the overburdened organism avoids a breakdown by throwing off the cause of its troubles.

INDICATIONS FOR THE INDUCTION OF PREMATURE LABOR.

The operation is indicated when the further continuance of pregnancy or labor at full term would expose mother or child to serious risks which might be diminished or avoided by the artificial arrest of gestation.

1. PELVIC DEFORMITY of such a nature as to prevent the birth of a living child at full term, and yet allow the safe delivery of a premature viable child, is one of the commonest indications. In such cases there is a disproportion between the mother's pelvis and the mature fœtus which must be overcome before safe delivery is possible. The head is too large for the pelvis, and as the size of the pelvis cannot be increased, it only remains to reduce the size of the fœtal head by provoking labor when it is smaller and more plastic. Practically, a distinction must be made between the common *flat pelvis* and the rare *generally-contracted pelvis*. In the former only the conjugate is narrowed, and a seven months' fœtus may be delivered safely through a conjugate of about 7.6 cm. (3 in.) or even sometimes 7 cm. (2¾ in.). Schroeder places the lowest limit at 6.75 cm. (2.66 in.). In the latter the lateral measurements are contracted as well as the conjugate, and a conjugate of 8 cm. (3.15 in.) is required. Korn of Dresden says that labor may be safely induced between the thirty-second and thirty-sixth weeks in *flat* pelves with a conjugate of 7 cm. (2¾ in.), or in *generally-contracted* pelves with a conjugate of 7.6 cm. (3 in.). Theoretically, the indication seems clear enough, but practically there are several important difficulties. In multiparæ the history of previous labors is usually a pretty safe guide; the indication is clear if on a former occasion craniotomy had to be performed, or there was great difficulty in delivery on account of pelvic contraction resulting in the death of the child. But in primiparæ the problem is not so easy, for we have not the experience of previous labors to guide us nor the measurements of previous children's heads. The practitioner should always inquire carefully into the personal and family history of his primiparous patients. If he finds any history of rickets, spinal curvature, hip disease, or any accident, injury, or disease liable to affect the shape or capacity of the pelvis, he should measure it at once.

Unfortunately, our people have not yet come to realize the practical importance of prophylaxis in obstetric matters. If patients would only place themselves under the charge of their medical attendants early in the course of their pregnancy, much suffering would be prevented, many lives saved, and dystocia and eclampsia robbed of half their terrors.

Another important difficulty arises when the time for operating has to be decided upon. We are unable in most cases to determine the date of conception, and yet this must be done approximately if we are to mark out correctly the limits of viability. If through miscalculation we operate too soon, the child will be lost; if too late, both lives may be placed in peril. Besides the degree of pelvic contraction, the size and plasticity of the fœtal head must be approximately made out. Schroeder measured the transverse diameter of the head in 68 cases of premature delivery where the period of gestation was accurately known, and found it to be larger than usually stated.[1] On the average his measments showed—

In the 36th to 40th week	8.83 cm. (3.48 in.).
" 32d " 36th "	8.69 cm. (3.42 in.).
" 28th " 32d "	8.16 cm. (3.19 in.).

The relatively large size of the head is partly counterbalanced, however, by its increased plasticity and compressibility. From the measurements of Burns, Salomon, Dubois, Stolz, Tarnier, and Budin, the biparietal diameter of the fœtal head is[2]—

At full term	9 to 9½ cm. (3.54–3.74 in.).
" 8½ months	8½ cm. (3.35 in.).
" 8 "	8 cm. (3.15 in.).
" 7½ "	7½ cm. (2.96 in.).
" 7 "	7 cm. (2.76 in.).

In young primiparæ the transverse diameter is relatively smaller than in older multiparæ, and the weight of the children seems generally to increase with the age of the mother and the number of previous births. Ahlfeld judges approximately of the length of the fœtus and the size of its head by measuring the length of the fœtal ovoid, but this method is open to so many errors that it cannot be relied upon as giving positive indications in individual cases. Müller (Bern) determines the relative proportions between the fœtal head and the pelvis by pressing the head down into the pelvis every eight days, and ascertaining by means of the fingers in the vagina whether the head can be made to enter the brim. Whenever it becomes hard to force the head into the brim it is time to operate.[3]

2. CERTAIN DISEASES which endanger the mother's life, induction of premature labor affording the best chance of averting the danger.

Placenta Prævia.—Whenever the diagnosis is made operative measures are usually required. If the child is not yet viable and the symptoms are not urgent, rest in bed and sedatives may tide the patient safely along till there is a fair prospect of saving the child. But it must always be borne in mind that in placenta prævia, when hemorrhage has once taken place, the patient is never safe till labor is over.

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[1] *Lehrbuch der Geburtshülfe*, 1886, S. 263.

[2] Charpentier: *Traité pratique des Accouchements*, tome ii. p. 704.

[3] *Centralblatt für Gynäkologie*, Bd. ix. S. 660.

Eclampsia.—Some difference of opinion exists as to whether labor should be induced at once or an expectant plan adopted. If the child is not viable and the convulsion not severe, there is no harm in putting the patient on suitable treatment and waiting in the hope of saving the child; but in the great majority of cases it is better practice to induce labor and deliver as soon as possible. Of course the operation must be done carefully and gently, with as little manipulation as possible, and always under an anæsthetic. The convulsions do not usually recur after labor is over; but if they do, they are generally fewer and milder. The induction of labor when eclampsia is threatening, but has not yet occurred, is an open question which must be settled according to the circumstances of the individual case.

Chorea, grave *heart and lung troubles*, uncontrollable *vomiting, jaundice, general œdema, excessive œdema of vulva, suppression of urine*, and other grave diseases occasionally make the induction of premature labor advisable.

3. When a *dead fœtus* remains *in utero* and is becoming a source of trouble, labor must be induced and the uterus thoroughly cleared out.

4. The operation has sometimes to be performed in the interests of the child, as when on a previous occasion a child has perished on account of the large size of its head or the unusual ossification of its cranial bones, or when death of the fœtus has habitually taken place during the last weeks of pregnancy.[1]

5. In those rare cases where the death of one twin occurs toward the end of pregnancy the induction of labor as soon as that fact has been discovered may save the life of the surviving child.

6. When the mother is likely to die before the completion of her full term it has been proposed to operate in the interest of the child, and thus avoid a post-mortem Cæsarean section. No rule can be laid down in such cases; the individual circumstances and the wishes of the patient and her friends must largely influence the course of action.

TIME TO OPERATE.—Charpentier[2] says that the fœtal head may be safely compressed 1 cm. (.39 in.),[3] and lays down the following rules for the selection of the proper time for operating:

1. In pelves with a conjugate of at least 9 cm. (3.54 in.), the fœtal

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[1] When the habitual death of the fœtus is caused by anæmia or chlorosis of the mother or changes in the cord or placenta, the operation may be of service; but when syphilis is the cause it will be of no use.

[2] *Traité pratique des Accouchements*, tome ii. p. 708.

[3] Baudelocque believed it possible to diminish the transverse diameter of the fœtal head by compression to the extent of a third or a quarter of an inch with safety to the child.

head at term being 9.5 cm. (3.74 in.), and being reducible 1 cm. (39 in.), labor should be induced in multiparæ between eight and a quarter and eight and a half months, according to the difficulty experienced in former labors and the estimated size of the fœtus: in primiparæ, the child being probably smaller, labor may be induced eight to ten days before full term, or even at full term.

2. In pelves of 8.5 cm. (3.35 in.), in multiparæ as well as primiparæ, labor should be induced between eight and eight and a half months.

3. In pelvés of 8 cm. (3.15 in.), between eight and eight and a half months at the very latest.

4. In pelves of 7.5 cm. (2.95 in.), between seven and a half and eight months.

5. In pelves of 7 cm. (2.76 in.), between seven and a half months and seven and three-quarters.

6. In pelves of 6.5 to 6 cm. (2.56 to 2.36 in.), at seven to seven and a half months at the latest.

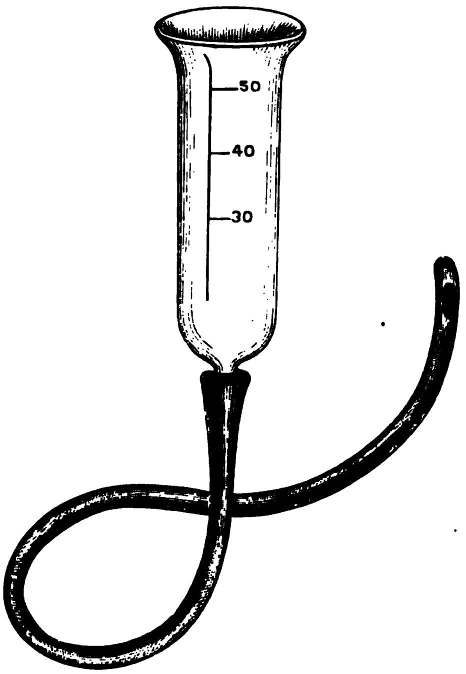
7. Below 6 cm. (2.36 in.) abortion should be induced, since it is very exceptional to get a living child through a pelvis below 5½ cm. (2.17 in.), and then cephalotripsy or embryotomy would be dangerous for the mother.

At an earlier period of gestation than the two hundredth day the viability of the child is improbable; between the two hundredth and two hundreth and thirtieth day it is doubtful; after the two hundred and thirtieth day it becomes probable. Usually, two hundred and forty to two hundred and fifty days from the cessation of the last menstrual period should be allowed to elapse before operating. If the pelvic contraction is great, it is better to err upon the safe side and operate too early rather than too late; if the contraction is moderate or slight, the operation should be deferred as long as possible. Schroeder usually operated in the thirty-sixth week, almost never before the thirty-fourth.

Prognosis.—For the mother it is usually good, but should be guarded. The mechanism of provoked labor differs somewhat from that of normal lacor. Gestation being incomplete, the preparations for labor are also incomplete: the uterus is immature, its contractile power less, its cervix harder and less dilatable, and abnormal presentations are more likely to occur. More manual interference is needed, and there is a greater risk of septic infection. The patient's general condition too is often bad; concurrent disease may complicate the result or be aggravated by the operation, so that the prognosis for the mother depends a great deal upon the cause which necessitates interference. The excitability of the uterus is another factor which must be taken into account: it varies greatly in different women; in some the slightest irritation will precipitate labor, while in others the uterus will scarcely respond to the most powerful stimuli. Danger does not always end when labor is completed: there are still many risks to run. The possibility of septic infection has always been a source of anxiety, but the perfecting of our antiseptic methods has reduced this to a minimum, so that now the maternal mortality from sepsis need be practically *nil.*

For the Child.—The younger the child the worse the prognosis. Between the thirty-second and thirty-sixth weeks the greatest care will be needed to preserve its life. But the wonderful improvements made by Tarnier and others in the artifical rearing of feeble infants very materially increase the chances of premature children, and may be said to have pushed back the limit of viability from the seventh to the sixth month. At La Maternité, Tarnier places feeble or premature infants in an incubator (couveuse) (Fig. 221, Vol. I. p. 535), which he keeps supplied with fresh air at a constant temperature of 85°–95° Fahr.; at the same time artificially feeding by means of a rubber tube (gavage) (Fig. 65) is methodically carried out. The results, as reported by Budin in a recent article in *La Semaine Médicale* are simply marvellous. With Tarnier's couveuse and gavage they have succeeded in saving—

FIG. 65.



Tarnier's Apparatus for the Artificial Feeding of Premature or Feeble Infants (gavage); Lüer's Model.

Children at six months	30.0 per cent.
" " seven "	63.6 "
" " eight "	85.7 "

Budin predicts that by further improvements in the rearing of premature children the mortality will be so much reduced that the artificial induction of premature labor will eventually replace craniotomy and Cæsarean section in all but the extreme degrees of pelvic contraction. Dr. Max Stauch[1] gives the statistics of the Moscow Clinic, and compares the maternal and fœtal mortality after premature labor and Cæsarean section as follows:

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[1] *Arch. f. Gyn.*, Bd. xxxi. Hft 3.

	Premature Labor.	Cæsarean Section.
Mother	0 per cent.	11.8 per cent.
Child	55 "	8 "

Prof. Leopold and his assistants, Korn, Löhman, and Präger, tabulate the statistics of the Dresden Clinic for four years, and compare the relative maternal and fœtal mortality after induction of premature labor, turning, craniotomy, and Cæsarean section.[1] In the forty-five cases where premature labor was induced,

35 mothers recovered without fever.
9 " had slight elevation of temperature for two or three days.
1 " died from sepsis.

	Maternal Mortality.	Fœtal Mortality.
Induced labor	2.2 per cent.	33.3 per cent.
Version and extraction	4.8 "	41 "
Craniotomy	2.8 "	100 "
Cæsarean section	8.6 "	13 "

Septicæmia was the cause of fœtal death after

Induced labor	in 2.2 per cent.
Version and perforation	" 0.0 "
Perforation	" 0.0 "
Cæsarean section	" 4.3 "

Wyder of Berlin analyzes 9000 cases of labor at the Charité and 6000 at the Policlinic, and compares the results of induced labor, craniotomy and Cæsarean section.[2] There were 306 cases of induced labor, with a maternal mortality of 3.9 per cent.; in the higher degrees of pelvic contraction none of the mothers were lost. He concludes that in contracted pelves the mortality after

Cæsarean section is 2.13 times greater than after craniotomy.
" " 3.27 " " " " induced labor.

For the relative indication (moderate contraction) the Cæsarean section shows a mortality 7.1 times greater than that after induced labor in highly-contracted pelves (5.5–7 cm.—*i. e.* 2.17–2.76 in.). He thinks that in highly-contracted pelves labor should be induced in the early months, for experience has shown that then the operation can be performed without risk to the mother if proper antiseptic precautions be adopted; but when pregnancy is far advanced Cæsarean section is indicated. He thinks this should be the rule of practice till the mortality after Cæsarean section has been reduced at least approximately to that after induced labor.

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[1] *Der Kaiserschnitt und Seine Stellung zur kunstlichen Frühgeburt, Wendung, und Perforation bei engem Becken.*

[2] *Archiv f. Gyn.*, Bd. xxxii. Hft. 1.

OPERATION.

Schroeder used to say that the English introduced the operation, but the Germans have formulated its indications and perfected its technique. The methods employed are either (I.) *medicinal* or (II.) *mechanical.*

I. MEDICINAL.—From time immemorial drugs have been used to provoke abortion. They act upon the uterus either directly or indirectly through the spinal centres. Hot climates seem to increase their efficiency. Drugs as abortives are unsafe as well as unreliable, and should never be employed to *provoke* uterine action, though occasionally they may be used to *intensify* it when present. The drugs which have been most commonly employed are ergot, quinine, savin, rue, borax, hamamelis, cinnamon, jaborandi, muriate of pilocarpine.

II. MECHANICAL.—These agents act either by direct mechanical dilatation or by stimulating the peripheral nerves.

1. *Puncturing the membranes* is probably the oldest method; it was the one used by Justine Siegmundin and the early English operators. Scheel the Dane recommended it in 1709, and on the Continent it is usually known as "Scheel's method." By means of a sound, sharpened goosequill, or some pointed instrument the membranes are punctured opposite the os uteri; the waters then drain away, the uterus contracts about its contents, the utero-placental circulation is disturbed, and regular uterine action is by and by set up. Scheel's method is most useful when the size of the uterus is to be reduced quickly. The objection to it is that the rapid discharge of the waters before the os and cervix have dilated is apt to make labor more tedious and painful for the mother, as well as more dangerous for the child.[1] To overcome this difficulty Hopkins (1826) advised tapping the membranes some distance above the os, so that the liquor amnii might drain slowly away while the os and cervix were dilating. Meissner constructed a long curved trocar for the high puncture of the membranes, but his instrument never became popular, and the sound or the Vienna goosequill is in general use.

2. *Introduction of an elastic bougie into the uterus,* known usually as "Krause's method," is on the whole the safest and best. Mampe (1838) recommended a flexible catheter to be passed up between the uterine wall and membranes several times in different directions, and

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[1] These objections do not apply with as much force to the induction of abortion where the child's life is not considered as they do to premature labor. The membranes are not any more likely to be retained than in a spontaneous abortion, and the treatment of retention is the same in both cases.

then withdrawn. In Holland, Lehman passed a bougie in a similar manner, but did not leave it in the uterus. Krause of Gröningen improved upon these methods by leaving the catheter in the uterine cavity till labor has fairly begun. It is better to use a solid bougie than a gum-elastic catheter, so that there may be less danger of air or septic matters finding their way into the uterus. If a catheter is used, its openings should be carefully closed with sealing-wax. The bougie or catheter should be new and kept immersed in a carbolic-acid solution till required for use. The strictest attention must be paid to antiseptic details during the operation.[1] The hands and arms should be carefully disinfected, a hot vaginal douche (sublimate or carbolic) administered, two fingers passed into the vagina up to the internal os, the bougie slipped along them as a guide into the cervix and through the internal os, and then made to work its way gently between the uterine wall and the membranes several inches up toward the fundus. During the introduction of the bougie, the membranes may be injured and the liquor amnii drain away; Scheel's method has thus been accidentally performed. The bougie is kept *in situ* by a vaginal tampon of iodoform gauze, which also acts as a plug to keep out air and septic matters. Labor usually begins in from four to twenty-four hours. In exceptional cases the uterine irritability is so slight that the bougie may remain *in utero* for days without provoking contraction. In one case fourteen days were insufficient to induce labor, and other means had to be tried. The method is simple, efficient, easily executed, and perfectly safe if antiseptic rules are strictly observed.

3. *Intra-uterine Injections.*—This method was first recommended by Schweighäuser (1825) and simplified by Cohen (1846), and now usually bears the latter's name. A special nozzle or an elastic catheter is introduced between the uterine wall and the membranes, just as in Krause's method; lukewarm water is then injected till the patient complains of tension. The membranes are thereby detached over a considerable area, and strong labor-pains soon begin. Though undoubtedly the method is efficient, it is objectionable on account of its danger: several fatal cases have been reported from shock and entrance of air into the uterine veins. More dangerous still is Lazarewitch's plan. He carries the nozzle right up to the fundus before injecting, because the seat of greatest uterine irritability is at the fundus.

4. *Vaginal and uterine irrigation*, commonly known as "Kiwisch's method." A stream of hot water[2] is allowed to play against the cervix

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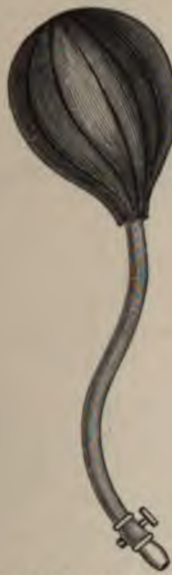
[1] For detailed account of antiseptic measures to be taken in the conduct of natural labor and obstetric operations, see Dr. Garrigues' article, p. 290.

[2] Some prefer a cold douche; others administer a hot douche to relax the parts, followed immediately by a cold douche, so that the sudden change of temperature may arouse uterine action.

for ten or fifteen minutes at a time, every two or three hours, till pains begin. The temperature of the water is variously recommended to be from 100° to 120° Fahr. The method is tedious and painful and apt to cause troublesome congestion; it has occasionally produced metritis, shock, and even death. On the Continent uterine irrigation is frequently used to soften the cervix and make it more dilatable before Krause's method is employed. Stauch of Moscow has shown that such practice is wrong, because douching tends to lower uterine irritability and retard the action of the bougie instead of helping it.[1] In his experience Krause's method always acts rapidly and well if the irritability of the uterus has not been previously blunted by Kiwisch's hot douche.

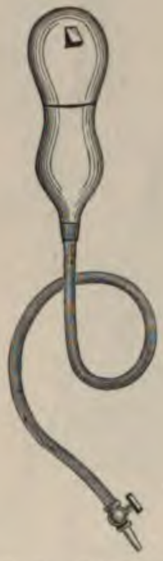
5. *Tamponing the Vagina.*—Braun's colpeurynter is occasionally of service when there is hemorrhage, particularly in placenta prævia: it is used also to strengthen pains which are getting feeble or to oppose counter-pressure to a presenting bag of membranes which we wish to keep from rupturing. The colpeurynter (Fig. 66) is a rubber bulb with a supply-tube, something like an ordinary water-pessary. A No. 3 or 4 water-pessary answers the purpose of a colpeurynter very well. It is introduced collapsed up to the cervix, and then inflated with hot or cold water. It is useful as an auxiliary means, but is too slow, painful, and uncertain to depend upon alone.

FIG. 66.



Braun's Colpeurynter, dilated.

FIG. 67.



Barnes' Fiddle-shaped Hydrostatic Bag, made in three sizes—a better model than that in Fig. 271, Vol. I. p. 708.

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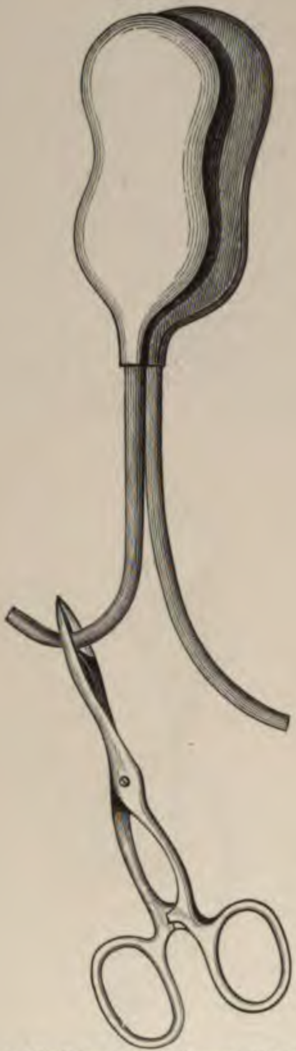
[1] *Archiv f. Gyn.*, Bd. xxxi. Hft. 3, S. 385.

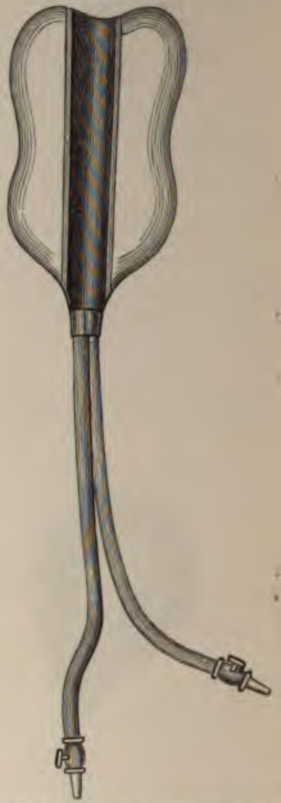
6. *Dilatation or Irritation of the Cervix.*—Steel dilators, sponge tents, laminaria tents, and elastic bags have at various times been proposed for this purpose. Hard dilators are apt to injure the parts, tents are apt to cause sepsis, and elastic dilators are useful only after labor has been excited in some other way and the cervix is already somewhat dilated. Barnes' fiddle-shaped bags (Fig. 271, Vol. I. p. 708, and Fig. 67) or McLean's modification of them (Figs. 68, 69) are occasionally very useful in hastening dilatation of the cervix in urgent cases of placenta prævia. Tarnier's intra-uterine dilator (Figs. 70, 71, 72) or Pajot's modification of it is much used in France, and is there highly spoken of.

FIG. 68.



McLean's Modification of Barnes' Hydrostatic Bags: one compartment is dilated and secured by a pair of compression-forceps; the other compartment is undilated.

FIG. 69.



McLean's Bags, both compartments dilated.

If the bulb is not sufficiently inflated, it is apt to be forced out of the cervix before labor is fairly started; and if too much inflated, it is apt to burst during any violent effort, such as coughing or vomiting, or even by the force of the labor-pains themselves. Tarnier's dilator is not likely to come into general use.

7. *Electricity.*—The faradic current was proposed by Herder (1803), and successfully employed by Hörninger (1844) and Jacoby. The galvanic current was adopted by Schrieber (1844). The use of electricity for this purpose never became general, and for a time was entirely dropped, but recently attention has been again directed to it. The mild faradic current is, on the whole, to be preferred. The negative pole is applied to the cervix in the posterior vaginal cul-de-sac, while the positive pole is placed over the sacrum or lumbar vertebræ. Care must be taken not to pass the current through the poles of the fœtal ovoid. The method is worthy of trial.

FIG. 70.

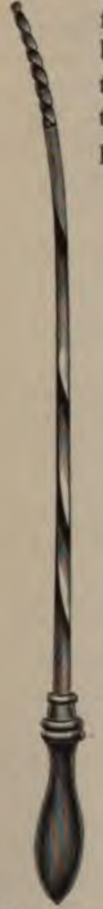


FIG. 71.

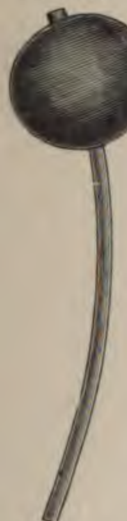


FIG. 72.

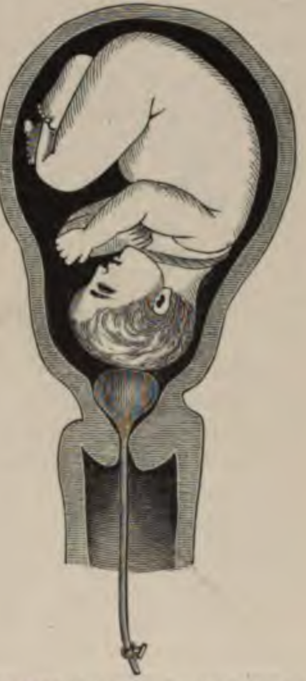


FIG. 70.—Tarnier's Cervical Dilator (Mathieu's model), unexpanded, ready for introduction into the uterus.
FIG. 71.—Tarnier's Dilator, expanded.
FIG. 72.—Tarnier's Dilator, *in situ.*

8. *Aspiration of the Uterus per Vaginam.*—Occasionally the ordinary

methods fail to induce abortion. If the case is pressing, nothing then remains but to puncture the uterus and aspirate the ovum. The fundus might be punctured *per rectum*, but there would be great risk of septic infection. The safest plan is to select, *per vaginam*, the most prominent portion of the uterine body and introduce the aspirator-needle at right angles to the uterine wall. When the waters have drained away uterine contraction closes the puncture, and if strict antisepsis has been observed there will be very little difficulty, except that abortion is apt to be incomplete.

Many other methods of very doubtful value have been proposed, such as D'Outrepont's friction of the fundus and body of the uterus, together with a course of baths and purgatives; Ritgen's rubbing of the os uteri; Hamilton and Merriman's detachment of the membranes from the lower segment of the uterus by means of the finger or a female catheter; irritation of the mammæ by sinapisms or blisters or by rubber suction-bulbs applied to the nipples.

When it is desired to conclude labor at a certain predetermined hour Barnes' plan should be tried. Over-night he *provokes* labor by passing a bougie, as in Krause's method; the next afternoon he uses what he calls his *accelerative* measures. Applying a binder to the abdomen so as to keep the head closely applied to the cervix, he introduces a small Barnes' bag and dilates to the size of three or four finger-breadths. Then he ruptures the membranes, and before the waters have all drained away inserts the large-sized bag and dilates till there is room for the child to pass. The case is then left to nature or terminated by forceps, turning, or craniotomy according to circumstances. During the puerperal period the patient will need the most watchful care.

Premature induction of labor is always a grave proceeding, and should not be undertaken without the most careful consideration. It is unwise for a physician to shoulder the whole responsibility of advising and operating if he can obtain the moral support and assistance of a confrère; whenever it is possible a consultation should be held. Besides the purely medical aspects of the case, there crop up sometimes moral and religious questions which are quite out of the province of the medical attendant. After the case has been clearly stated to the patient and her friends, the decision of such questions should be left to them and their religious advisers. If a practitioner has any regard for his own peace of mind, he will not operate till he has obtained the full and free consent of both family and consultants.

VERSION.

By JAMES C. CAMERON, M.D.,

MONTREAL.

Version, or *turning*, comprehends all those manipulations by which the long axis of the fœtus *in utero* is brought into coincidence with that of the pelvis, and a favorable presentation substituted for one that was relatively unfavorable. Either the *cephalic* or *pelvic* pole may be caused to present; a transverse presentation may be turned either to the head or breech; a breech presentation may be turned to the head or a head presentation to the breech. After version proper has been performed the case may be left to nature or else terminated by artificial extraction.

HISTORICAL NOTE.—1. *Cephalic version* is the most ancient, and at the same time the most modern, method of turning. Even in the earliest times we find attempts being made to convert unfavorable presentations into those of the vertex. Hippocrates taught that the fœtus could not be delivered otherwise than head first; this doctrine, long prevalent, was opposed by Celsus, but afterward reaffirmed and propagated by Galen. The older methods of turning were rude and barbarous, and apparently attended with only moderate success, for we find Albucasis writing as late as 1122 that version will succeed "in case it please God." The Arabians turned all other positions to the head; in cross-births the prolapse of an arm seemed to give them very little uneasiness; they simply cut off enough to make room for the descent of the head. In Europe it[1] remained a favorite operation till the middle of the sixteenth century, but after that time it gradually gave way to podalic version, which was introduced by A. Paré (1550). The opposition of Mauriceau (1688) and De la Motte (1721) for a time virtually banished it from France. Velpeau says that in the seventeenth and the beginning of the nineteenth century cephalic version was rarely mentioned unless to be condemned. Justine Siegmundin (1690) recommended cephalic as preferable to podalic version in some cases. She was probably the first to understand partially the relative merits of the two operations. Deventer (1710) recommended cephalic version before rupture of the membranes. In England, Smellie (1751) tried it, but soon gave it up; Aitken (1784) maintained that podalic version should never be tried till it is evident that cephalic version is no longer possible. The general revival of the operation dates from the beginning of the present century, and is mainly due to the efforts of two men, Flamant of Strasburg (1795 to 1803) and Wigand of Hamburg (1803 to 1807). Flamant practised the *internal* method, Wigand the *external* method with posturing. Wigand, having observed some cases of spontaneous version, strove to imitate artificially what he had seen occur naturally. After the appearance of his monograph cephalic version by the external method became popular in Germany, and has ever since been a favorite operation there. In France, Hergott's translation of Wigand's book (1851) first directed general attention to the operation, and its ultimate success was secured by the powerful advocacy of Tarnier and his pupils, Chantreuil, Budin, and Pinard. In England and America it never took firm root, and only recently can it be said to have taken its proper place among obstetrical operations. Though Wigand's book was known to Rigby (1841), Churchill (1842), and Ramsbotham (1844), the operation was scarcely mentioned by them. Indeed, it was not till Braxton Hicks (1860–63) announced his combined method of external and internal version that general attention was called to the possibilities of cephalic version. It now receives the sanction of most obstetricians in England and America.

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[1] Rhodion says that when one foot presents it should be pushed back, and the woman, lying head downward, should writhe and struggle and toss herself about, so that the head may come down.

2. *Podalic Version.*—Before the Christian era cephalic version was the only method of turning in use, breech as well as transverse presentations being, if possible, turned to the head. Though Celsus (30 B. C.–14 A. D.) recommended podalic version if the fœtus is dead, Soranus (98–117 A. D.) was the first to advocate it if the fœtus is alive. Though the teachings of Soranus were accepted by Moschion (117–138 A. D.), Galen (131 A. D.), and others, they were not generally adopted, for Tertullian (200 A. D.) writes that in transverse presentations embryotomy must be performed if cephalic version is not practicable. After the fall of Rome the darkness of the Middle Ages settled over Europe, and medicine shared the fate of science and letters. Through the influence of ignorance and superstition the practice of obstetrics was divorced from that of medicine and surgery, and fell into the hands of untrained, uneducated midwives. With the dawn of better days, however, it slowly regained its old status. Cephalic version was evidently known to a few, but podalic version was practically unknown till the time of A. Paré (1550). To him belongs the credit of having restored the operation, and practised it even in head presentations when labor had to be terminated rapidly. His pupil Guillemeau (1609) improved its technique and formulated its indications. The new operation gained rapidly in public favor till from the time of

Mauriceau (1668) it practically superseded cephalic version. Portal (1685) was the first to recommend bringing down one foot instead of two, and Puzos (1753) explained why delivery as a half-breech is more favorable for the child than as a complete footling. Ould of Dublin, the second master of the Rotunda, was the first to recommend podalic version as an elective operation in cases of pelvic deformity (1739–42). Among the early operators version was immediately followed by extraction till Deleurye (1770) pointed out that version really comes to an end when rotation is complete, and that extraction is a supplementary procedure with indications and contraindications of its own. Similar ground was taken by Denman in England (1788) and Boër in Germany (1791). Although Wigand and others had recognized the principle of combined external and internal manipulation, and had adopted it in cephalic version, Braxton Hicks (1860–63) was the first to describe definitely a combined method applicable to both varieties of version even before the os is fully dilated. In using his method it is not necessary to introduce the hand into the uterine cavity, but as soon as one or two fingers can be passed through the os and cervix a foot or knee can be seized and drawn down. Braxton Hicks' method is the crowning glory of podalic version, and deservedly ranks as one of the most important advances in conservative midwifery achieved during this century.

NOMENCLATURE.—Confusion in nomenclature is undoubtedly responsible for much of the haziness of professional opinion regarding version. For example, I have found Braxton Hicks' method of turning in cases of placenta prævia variously described by different writers as—(1) combined internal and external version; (2) combined internal and external podalic (or pelvic) version; (3) combined podalic (or pelvic) version; (4) bimanual podalic version; (5) combined bimanual podalic version; (6) combined bipolar version; (7) combined internal and external bipolar version; (8) combined bipolar podalic (or pelvic) version; (9) bipolar podalic (or pelvic) version; (10) combined internal and external bipolar podalic (or pelvic) version. Is it any wonder that many practitioners have a hazy idea of what Braxton Hicks' method really is? It is not at all necessary to adopt a cumbersome or confused nomenclature: it may be made very simple.

1. As the fœtal ovoid has but two poles, the *cephalic* and the *pelvic*, the fœtus must be turned to one or other of them: when it is turned to the head the operation is called *cephalic* version; when turned to the breech, *pelvic* version. *Podalic* version, or turning to the feet, is a variety of *pelvic* version, and should be classed as such.

2. Version is performed by *external* manipulations only, by *internal* manipulations only, or by *external* and *internal* manipulations combined. The method of operating may be described, therefore, as *exter-*

nal or *internal* or *combined*. Hence all cases of version may be classified as

$$\left.\begin{array}{l}\text{External,}\\ \text{Internal, or}\\ \text{Combined}\end{array}\right\} \left.\begin{array}{c}\text{Cephalic}\\ \text{or}\\ \text{Pelvic (podalic)}\end{array}\right\} \text{Version.}$$

Bimanual means that both hands are used, but as both hands should be used in all cases, the term is superfluous. *Bipolar*, a term proposed by Barnes, means that during turning the two poles of the fœtus are acted upon simultaneously or alternately by the two hands, each of which controls one pole. A *bipolar* version must therefore be *bimanual*, though a *bimanual* version need not be *bipolar*. The term *bipolar* is useless and often misleading, for certainly the combined method of Braxton Hicks cannot be correctly described as either a *bipolar* or a *combined bipolar* version.

I. CEPHALIC VERSION is usually performed in order to improve or rectify a relatively unfavorable position; it is not often employed when speedy delivery is imperative. It is easier when done early, and more likely to succeed when the membranes are unruptured, the os not fully dilated, and the pains not yet regular or strong; although ruptured membranes, a well-dilated os, and strong pains do not necessarily make success impossible. The nearer the head lies to the os, the more easily can it be made to present.

Indications.—Pinard, one of the chief advocates of external cephalic version, maintains that if the fœtal head has not entered the brim by the end of the eighth month we may infer that the accommodation between it and the pelvis is abnormal, incomplete, or altogether faulty. If at that time it occupies either iliac fossa or the superior segment of the uterus, it is in the wrong place and must be set right: in a word, if during the last month of gestation the fœtal head is not in the excavation, it must be put there.[1] When the head has been made to engage in the brim a strong abdominal supporter is applied to keep it in position (Figs. 73, 74). In multiparæ, if at the end of the eighth month the fœtal head is not in the excavation, even though situated in the lower segment, he applies his abdominal supporter to force it down and prevent it from being accidentally displaced. By this means he hopes to correct or prevent all shoulder, breech, and face presentations, and have nothing but normal presentations of the vertex. If the operation is to succeed, a precise diagnosis must be made of the position of the fœtus *in utero*, the uterus itself must not be too irritable, the fœtus must be sufficiently movable, and when version is complete the vertex must be kept *in situ* till active labor has fairly begun.

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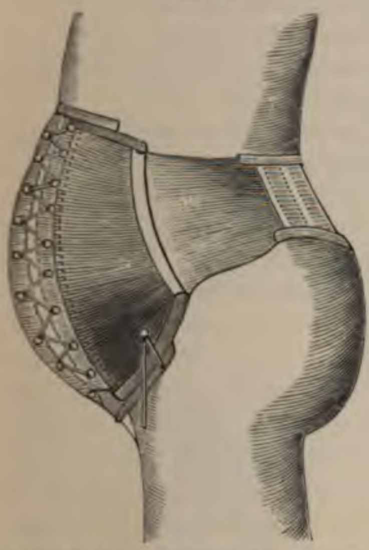
[1] "Si dans le dernier mois de la grossesse, la tête du fœtus n'est pas dans l'excavation, il faut et on peut l'y mettre" (*Traité du Palper abdominal*, Pinard, p. 222).

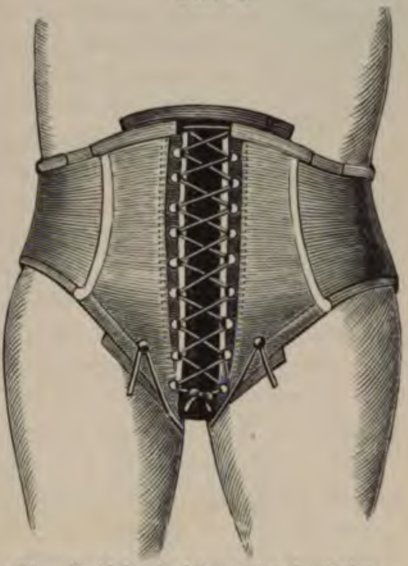
Contraindications.—Pelvic contraction, though sometimes considered a contraindication, is not really so unless it be too great to allow axis-traction forceps to be applied at the brim; on the contrary, moderate pelvic contraction should be one of the strongest indications for cephalic version. When the pelvimetry of primiparæ is more generally practised, and physicians are able to estimate more correctly the various kinds and degrees of pelvic contraction, I believe that external cephalic version, followed by the high-forceps operation, will be generally preferred to podalic version, and will yield better results for both mother and child.

FIG. 73.



Pinard's Abdominal Supporter, side view.

FIG. 74.



Pinard's Abdominal Supporter, front view.

Prolapse of funis is generally a contraindication, because podalic version gives the child a better chance than cephalic version, reposition of the cord, and forceps.

Imperfect mobility of the fœtus *in utero* is the main contraindication, according to Pinard. This impaired mobility may be due to either maternal or fœtal causes—*e. g.:*

1. *Multiple Pregnancy.*—Version is possible only after the birth of the first child;

2. *Breech Presentations in Primiparæ.*—When the presenting part remains fixed and does not yield to gentle effort;

3. *Shoulder presentations* complicated with malformation of the uterus;[1]

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[1] Malformation of the child in rare cases prevents version or renders it very difficult. Dr. MacCallum of Montreal reports a case where hydrocephalus was the obstacle.

4. *Labor.*—The mobility of the fœtus is impaired or destroyed when the waters come away. Pinard then dreads that manipulation may produce a prolapse of the cord or extremities or a face presentation. But, on the other hand, cephalic version has been often performed successfully during the progress of labor, and I am not aware of any authentic case of prolapsed funis or of face presentation directly resulting from the performance of cephalic version during labor.

If external manipulations fail, the combined method may be tried, and if that also fails, podalic version is still available.

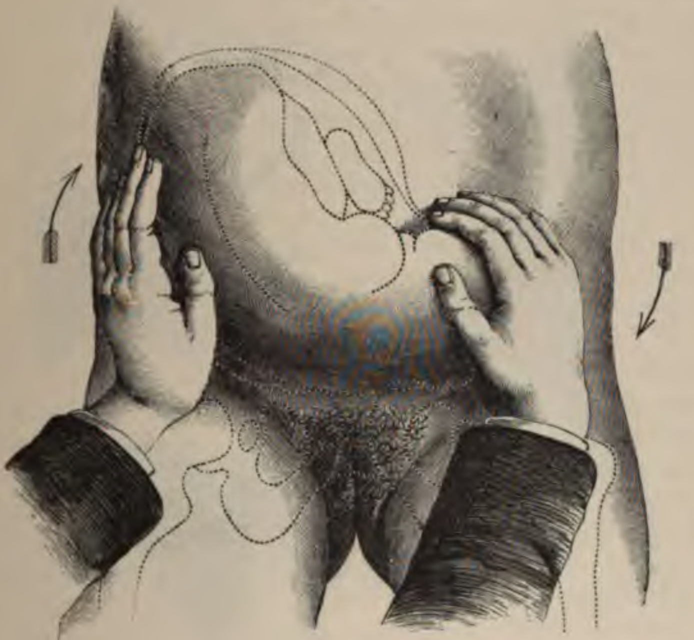
Considerable difference of opinion exists as to the proper limitations of cephalic version. In *transverse* presentations most authorities are now agreed that it should be tried when the fœtus is freely movable and undue force is not required; but in *breech* presentations the majority do not yet consider it either necessary or advisable. It is argued that in primiparæ, in whom breech presentations are hardest to manage and version would be most useful, the operation is rendered difficult, or even dangerous, by the rigidity of the uterine tissues; while in multiparæ, in whom the tissues are lax and manipulation easy, breech cases usually end favorably and version is not required. In America, at all events, external palpation will need to be more generally practised and greater manipulative skill acquired before cephalic version comes to be generally adopted in breech presentations. It is a serious defect in our obstetrical teaching that students are not more earnestly impressed with the value of external palpation and systematically trained in its use. Perhaps the fault may be due in large measure to lack of clinical facilities; but, however that may be, it is the manifest duty of our medical schools to see that their students have systematic clinical instruction in external palpation and pelvimetry. By constant practice only can a practitioner obtain that diagnostic and manipulative skill which are requisite for success in external cephalic version. What this operation is capable of doing is well shown in Pinard's wards at the Lariboisière Hospital, where, if the cases are seen in good time, abnormal presentations are diagnosed and rectified and all cases terminated as presentations of the vertex.

METHODS.—1. *Posturing.*—If the waters are not away and the head is lying somewhat to one side, place the patient upon that side with a pillow under the abdomen. For example, if the head is lying to the left, place the patient on her left side, so that the fundus and breech may fall over to the left, and in so doing may dislodge the head and tilt it over the pelvic brim. If the manœuvre is successful, turn the patient over upon the back immediately, so that the head may not glide away again, and apply an abdominal supporter to keep it fixed in the pelvic brim till the onset of active labor. In *transverse* presentations this method never succeeds, and under any circumstances it is uncertain and unreliable.

2. *External Method.*—Place the patient in the ordinary position for abdominal palpation—viz. on the back, close to the edge of the bed, with legs extended and slightly separated, and arms extended beside the body. Among the French it is customary for the operator to stand beside the patient opposite her thighs and looking up toward her head; among the Germans he usually stands opposite her waist, looking down toward her feet; but some obstetricians prefer placing the patient across the bed in the dorsal position, and standing directly in front of her between her thighs while operating. The manipulations should be performed only when the uterus is thoroughly relaxed, never during a pain.

(1) In *transverse* presentations, the head being in one iliac fossa and the breech in the opposite flank. Apply one hand over the head, the other over the breech; then by means of gentle sustained pressure exerted simultaneously try to press the breech up with one hand and draw the head down over the pelvic brim with the other (Fig. 75).

FIG. 75.



(2) In *breech* presentations, the head being in the upper uterine segment, Pinard's[1] method is as follows: (*a*) First make the fœtus movable. In multiparæ this is easy, because both extremities of the child are usually accessible and the lax abdominal walls permit free movement of the fœtus; in primiparæ, especially if near full term and if the

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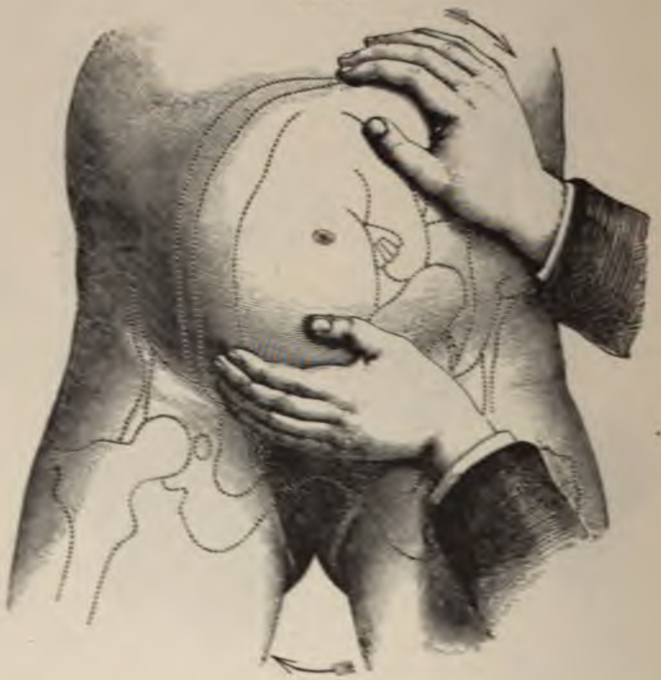
[1] *Traité du Palper abdominal*, pp. 185–189.

presentation be the result of true accommodation, the fœtal extremities can be but partially controlled by the operator's hands. If the head is hidden under the false ribs and coils of intestine lie between the uterus and the abdominal wall, the head may be displaced and brought within reach either by pressing it down upon one side or by displacing the breech. In incomplete breech presentations, though the head may be readily accessible, the breech may sometimes press slightly into the pelvic cavity, and be incapable of manipulation. By means of a finger in the vagina the inferior uterine segment should then be lifted above the brim and the breech pushed over toward one of the iliac fossæ, while slight pressure is made in an opposite direction over the cephalic extremity. (*b*) Both fœtal extremities being movable and accessible, apply the hands over them, and by slow, continuous pressure cause the breech to ascend and the head to descend by the shortest route. (See Fig. 76.) Pressure made over the *pelvic* extremity is more efficient

FIG. 76.



than that made over the *cephalic*. In the majority of cases pressure should be in the direction of flexion; occasionally however, it must be made in the opposite direction, and in such cases extension of the head need not be feared if care be taken not to press upon the cephalic extremity only. In primiparæ the operation is far more difficult than in multiparæ, and the pressure needs to be more sustained and prolonged. (*c*) If after several attempts the fœtus cannot be made to rotate the operation should be abandoned.[1]

3. *Combined Method.*—If the external method is contraindicated or has failed, the combined method should be tried. Various procedures have been recommended, most of which have now little more than historic interest.

Busch introduced the hand corresponding to the *head*, ruptured the membranes high up, and endeavored to draw the head down into the pelvis, while the external hand steadied the uterus and pushed up the breech.

D'Outrepont introduced the hand corresponding to the *breech*, and tried to lift the presenting shoulder and push it over toward the breech, while the external hand simply steadied the uterus.

Scanzoni improved D'Outrepont's method by making the external hand press down the head from the iliac fossa toward the pelvic inlet.

Wright of Cincinnati, like Busch, introduced the hand corresponding to the fœtal *head*, and, like D'Outrepont, seized the presenting shoulder, but did not attempt to raise it; he pushed it laterally, so as "to give the body of the fœtus a curvilinear movement." With the external hand he dislodged the breech and moved it toward the centre of the uterine cavity. The body being thus bent upon itself, the head was gradually drawn toward the brim without any direct pressure being made upon it.

These methods all require the fœtus to be movable and the os well dilated. The methods of Hohl and Braxton Hicks are of greater practical value, because they may be used in cases where the os is only wide enough to admit two fingers.

Hohl, like Busch, introduced the hand corresponding to the fœtal *head*, passed two fingers into the cervix, and pushed the presenting shoulder over toward the breech. The external hand meanwhile pressed the head down toward the brim, while an assistant grasped the fundus with both hands and guided it toward the side where the head originally lay.

Braxton Hicks, unlike the other operators, prefers the *lateral* position. When the patient lies on her left side he introduces the left hand; when on her right side, the right hand. With two fingers of the internal hand passed up to the presenting part, like Hohl he pushes the shoulder in the direction of the breech, while with the external hand, like Scanzoni, he presses the head down toward the brim till it is received on the tips of the fingers inside the os. It may then be directed to whatever position is desired. Sometimes the external hand is made to do double duty, alternately pressing the head toward the brim and the breech toward the fundus. No assistant is required.

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[1] Cazeaux remarks that external cephalic version is not a popular operation, and assigns two reasons: (1) the inefficiency of the operation before labor: (2) the difficulty of the operation during labor. Pinard adds another reason: (3) insufficient knowledge of palpation.

II. PELVIC VERSION.—1. *Turning to the breech* is very seldom done. Occasionally, when the os is only slightly dilated and cephalic version has failed, turning to the breech may be tried. Kleinwächter says it is indicated when the pelvis lies nearer the inlet than the head does and cephalic version would be difficult or impossible. Pelvic version may be accomplished either by external manipulations or by the combined method, as in cephalic version.

2. *Podalic Version.*—Turning to the foot is a variety of pelvic version in which the feet or knees are seized and the child made to rotate *in utero* by traction upon them. The operation is safer for the child when only one foot or knee is brought down.

Indications.—There are three principal indications for podalic version:

(1) In *transverse* presentations, when cephalic version is impracticable or unadvisable, or when for some reason podalic version is safer for mother or child;

(2) In *head* presentations if the ordinary course of labor is apt to endanger mother or child, as in placenta prævia, prolapse of the cord, deformity of the pelvis or fœtus, face presentations, etc.;

(3) In *urgent cases* when there is no time to lose, and when delivery can be soonest effected by turning to the foot and extracting, as in eclampsia, hemorrhage, rupture of the uterus, pressure on the prolapsed cord, etc.

In the first two classes the case may be left to nature after version has been completed, but in the third class extraction must immediately follow version.

Essential Conditions.—1. The os should be dilated or dilatable, full dilatation not being necessary. Braxton Hicks' method may be employed when two fingers can be passed through the os. A soft dilatable os and unruptured membranes make the operation much easier.

2. The uterus must not be so firmly contracted upon its contents that rotation of the fœtus *in utero* is rendered difficult or dangerous. The injudicious use of ergot and early loss of the liquor amnii are the two causes which most frequently excite the uterus to mould itself to the contour of the fœtus.

3. The presenting part must not be so firmly engaged that it cannot be safely dislodged. Forcible attempts to dislodge a presenting part which has become wedged in the pelvis may quite easily cause rupture of the uterus.

4. The pelvis must not be too contracted. With a conjugate less than 2¾ inches (7 cm.) version at full term is unsafe. In oblique contraction version is admissible if it be so performed that the widest part of the head is brought into the roomiest side of the pelvis.[1] The brim of a narrow pelvis should not be so filled up with the presenting part as to prevent the introduction of the hand.

5. *An Exact Diagnosis.*—A careful external and internal examination should be made, so that the position of the child may be accurately determined and the condition of the os and the presenting part ascertained.

PROGNOSIS.—This varies greatly according to the circumstances under which the operation is performed. If under *favorable* circumstances, the prognosis for the *mother* will be good; for the *child*, not so good, especially if the patient is a primipara. If under *unfavorable* circumstances, such as contraction of pelvis, placenta prævia, or eclampsia, the prognosis will be worse for both, but particularly for the *mother*, whose danger is increased enormously by the complications as well as by the injuries produced during forcible extraction.

PRELIMINARY DETAILS.—Before operating prepare for every emergency. Make everything ready beforehand, for during extraction there will be no time to waste. Provide filets, an elastic catheter as a filet-bearer, and a pair of long forceps (axis-traction) in the event of difficulty with the after-coming head. As the child is apt to be born asphyxiated, have the proper means for resuscitation at hand, such as warm towels, blankets, hot water, high wines, etc. Empty the bladder and rectum, and, unless specially contraindicated, administer an anæsthetic, particularly if the patient is a primipara. From rigidity of the perineum or resistance at a critical moment many a child's life has been lost which might have been saved by the timely use of an anæsthetic.

Position of the Patient.—Some prefer the dorsal and others the lateral position;[2] some place the patient across the bed, and others at the side of it. In the lateral position it is easier to pass the internal hand up into the uterine cavity and grasp a foot or knee, but the external hand works under greater mechanical disadvantages, and cannot therefore give as much assistance as in the dorsal position. *Turning* may perhaps be easier in the lateral position, but *extraction* is certainly easier in the dorsal. Some do not place the patient across the bed unless difficulty is anticipated, but we cannot be sure in any case that there will be no difficulty, and a few moments' delay in the stage of extraction may be fatal to the child. It is far better in every case to be prepared for possible difficulties, and to arrange the patient so that she can be delivered easily and rapidly. Place her across the bed, with her hips close to the edge, on her side or back. If the lateral position is preferred for version, the patient can be easily turned over upon the back for extraction if necessary. If the dorsal position is to be used, a table or high bed should be prepared, for version cannot be performed with dexterity or comfort if the patient is on a low bed with spring or wire mattress.

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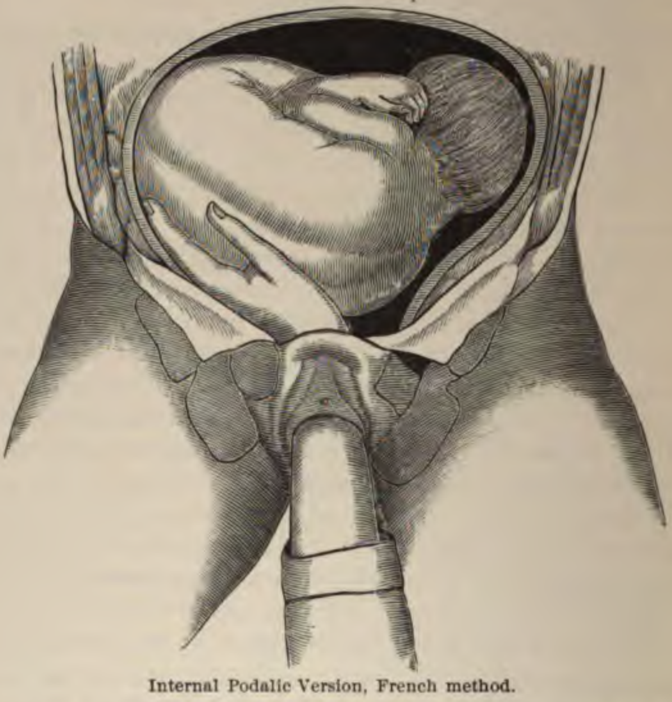
[1] Unless the pelvis is very large or the fœtus very small, the foot that is brought down always comes to the front. If the right half of the pelvis is roomiest, bring down the right foot, and the occiput will be thrown over into the right half of the pelvis. If the left half is the largest, bring down the left foot.

[2] Two essential points are that the vulva and perineum be quite free, so that nothing may impede the operator's movements, and that the body be so supported that the pelvic and abdominal muscles are kept relaxed.

Choice of hand is a matter of secondary importance. Some obstetricians prefer one hand, and some the other; moreover, if one hand becomes cramped and tired during the operation, it must be replaced by the other. English obstetricians place the patient on the left side and introduce the left hand. The French and Germans place the patient on the back and use the right or left hand according to circumstances. In dorso-anterior transverse positions the French select the same hand as the presenting shoulder, while the Germans use the hand corresponding to the side on which the feet are to be found (Figs. 77 and 78). For example, if the child is lying with back to the front, head in the left

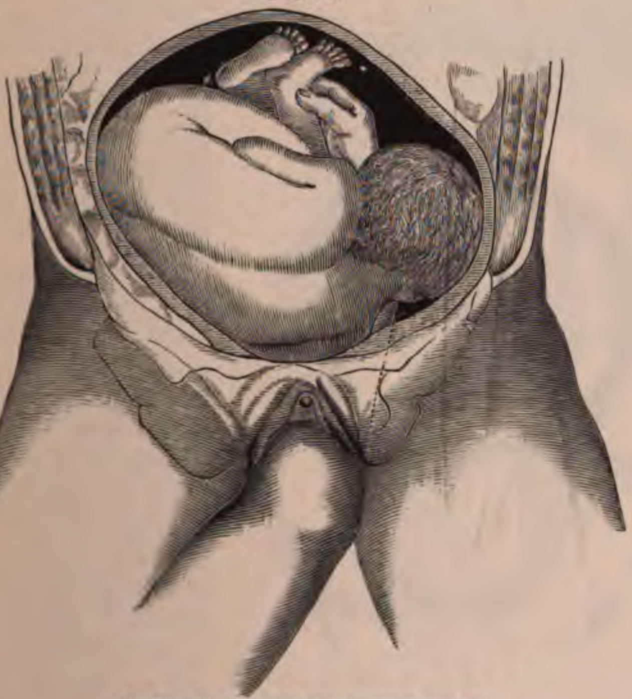
FIG. 77.



Internal Podalic Version, French method.

iliac fossa, feet on the right side, and right shoulder presenting, the French would use the *right* hand and the Germans the *left*. In dorso-posterior transverse presentations both French and Germans would use the same hand. The difference between the French and German methods as regards the choice of hand is explained by the fact that the French

FIG. 78.



Internal Podalic Version, German method.

pass the hand along the side, hip, and thigh of the child as a guide to the knee or foot, while the Germans pass the hand directly up to the anterior plane of the child, and thence, without any guide, toward the spot where the foot or knee is expected to be found. As a rule, the hand whose palm faces the abdomen of the child will seize the foot more readily and effect rotation more rapidly than the other. When once the operator has introduced his hand into the uterus, he should not withdraw it, if possible, till version is complete, even if it turns out to be the wrong hand theoretically; he should merely adopt the form of manipulation (French or German) for which the hand *in utero* is best suited.

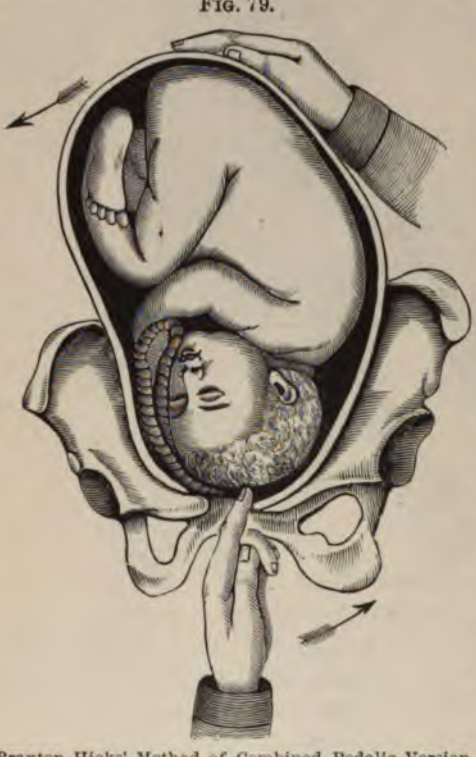
Of far greater importance than the choice of the hand is a *correct diagnosis.* If by means of external palpation the practitioner is able to make a correct diagnosis and form a mental picture of the relative position of the fœtal parts and the maternal structures, he will find version a comparatively simple matter.

In the operation of turning three stages are usually described: 1, the introduction of the hand and search for the foot or knee; 2, the rotation of the fœtus *in utero;* 3, extraction.

METHODS OF OPERATING.

1. *Combined Method of Braxton Hicks.*—After the bladder and rectum have been emptied, an antiseptic vaginal douche administered, and the operator's hands and arms thoroughly disinfected, the patient should be chloroformed and placed in the left lateral position.[1] The back of the left[2] hand and arm (never the palm) having been well oiled, the labia are held apart by the right hand, while the left is made cone-shaped and introduced wholly or partially into the vagina, so that two fingers may be passed up through the os till their tips touch the presenting part. In primiparæ especially this manœuvre must be performed with great gentleness and patience, pressure being made upon the perineum and not upon the symphysis and soft parts in front. If the *head* is presenting, it must be propelled toward the side on which the occiput lies. For example, if the vertex presents in the first position, the fingers inside the uterus gently lift the head and push it toward the left ilium, while the right hand outside presses the breech over toward the right side (Fig. 79). As the head glides away toward the

FIG. 79.



Braxton Hicks' Method of Combined Podalic Version, first stage: One or two fingers of the left hand lift the head from the brim and push it toward the left iliac fossa, while the right hand pushes the breech transversely toward the right side (Hicks).

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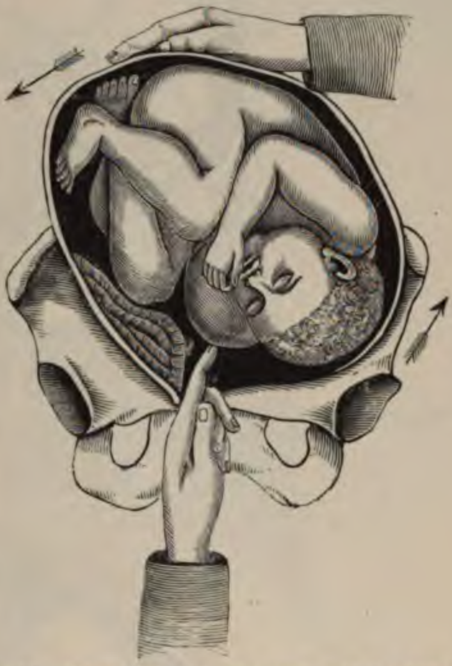
[1] Where the dorsal position is preferred the right hand is usually chosen when the feet of the child are turned to the right side; the left hand, when they are turned to the left.

[2] In Germany, when the patient lies on the right side the left hand is used; when on the left side, the right hand.

left the shoulder comes within reach, and is pushed along in a similar manner (Fig. 80). When the breech has been pressed well down into the iliac fossa, the membranes are ruptured during a pain. A knee will then be found not far from the os internum, and can be readily hooked down into the vagina (Fig. 81). The outer hand is then removed from the breech and transferred to the head. The simultaneous action of downward traction upon the leg and upward pressure upon the head readily causes rotation of the fœtus (Fig. 82). In *transverse* presentations the presenting shoulder is first gently dislodged, and then similar manipulations employed.

FIG. 80.

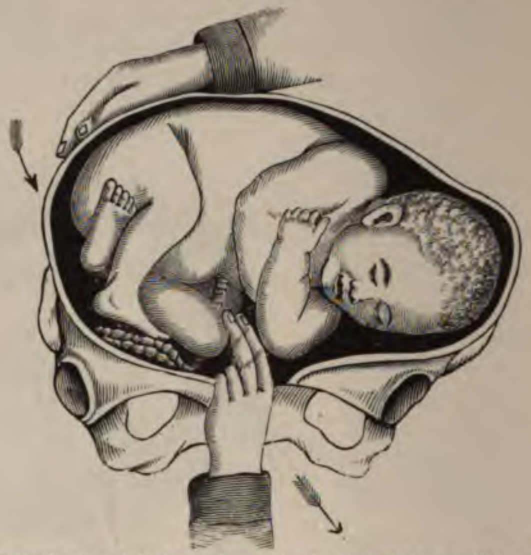


Braxton Hicks' Method, second stage: The left hand pushes the shoulder to the left, while the right hand pushes the breech to the right and downward (Hicks).

The combined method usually succeeds if the liquor amnii is still present or has but recently drained away and considerable fœtal mobility remains. If it fails, the whole hand must be passed into the uterine cavity and search made for a knee or foot.

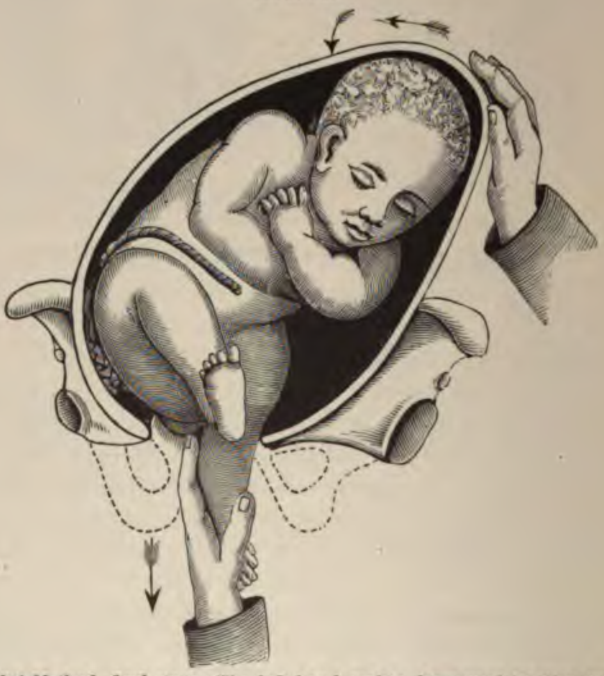
2. *Internal Method.*—In *transverse* presentations, the os being sufficiently dilated and the membranes unruptured, oil the hand, and in the interval of the pains pass it into the vagina. Rupture the membranes opposite the os internum, and immediately pass the hand into the uterine cavity with the palm toward the abdominal aspect of the child. Search for a foot or knee, seize it, and draw it down through the os into the vagina. Version proper is finished when the breech has been brought down so as to present at the brim. During these internal manipulations the external hand must keep the uterus under constant control, pushing it well downward to prevent overstretching of its vaginal attachments and to bring the fœtal members in the direction of the inside hand (Fig. 83). The feet are usually situated pretty high up, and the hand has often to be passed to the fundus before a foot can be seized. Difficulty in finding a foot is often due to the fact that the hand has not been introduced far enough and search has been made too low down.

FIG. 81.



Braxton Hicks' Method: The right hand forces the fœtal limb down within reach of the left hand, so that the fingers may be hooked over the knee (Hicks).

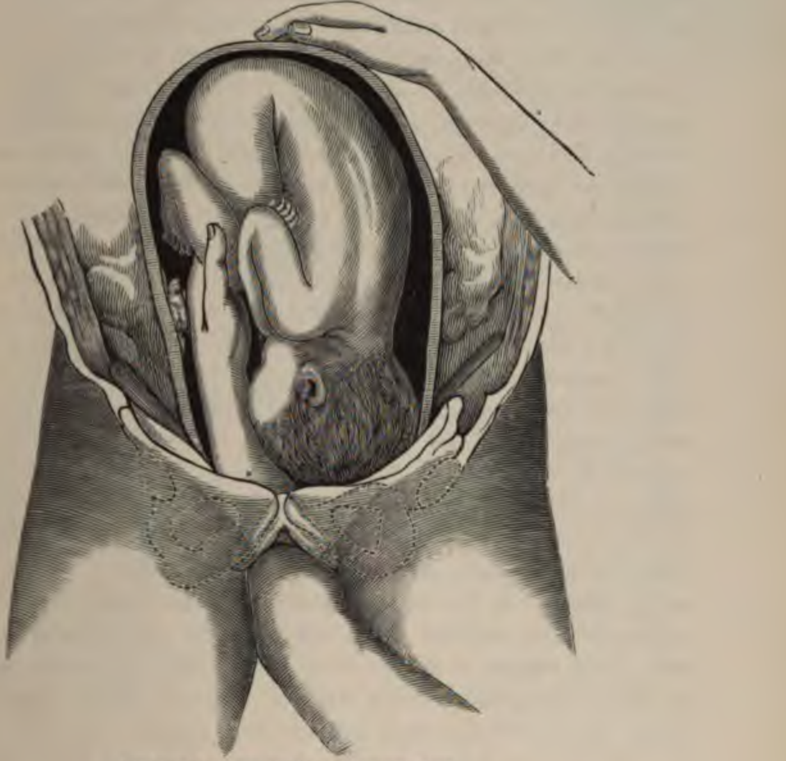
FIG. 82.



Braxton Hicks' Method, final stage: The left hand makes downward traction upon the leg, while the right hand presses the head upward. When the long axis of the child coincides with that of the uterus, the right hand makes downward pressure.

Should one foot or both be brought down? If *only one*, which? These questions have been long and learnedly discussed, but it is now pretty well agreed that if possible only one foot should be brought down. In primiparæ particularly, when the case is conducted as a half-breech, the soft parts are better dilated, the thorax, arms, and after-coming head are delivered more rapidly, and the child is less likely to perish during extraction than when it is dragged through structures which are rigid and only slightly dilated. In exceptional cases, when turning with one foot is difficult, both must be seized and brought down.

FIG. 83.



Podalic Version in Head Presentation.

Which foot or knee should be selected? In *dorso-anterior* positions most authorities agree that the nearest (lowest lying) foot is the proper one to bring down. In *dorso-posterior* positions there is more difference of opinion: Tarnier, Charpentier, Depaul, Martin, Scanzoni, Lange, Schroeder, etc. advise the lower foot, while Hohl, Kristeller, Simpson, Barnes, and others prefer the upper. Barnes strongly advocates grasping the knee instead of the foot, and prefers the upper one in all cases. Scharlan and Von Haselberg, on the other hand, contend that when the upper foot is drawn down it is apt to become crossed with the lower one, twisting the body so as to cause injurious pressure or make turning impossible. According to Fritsch, it is all the same which foot is grasped, because the back is directed posteriorly during version and comes to the front only during extraction. According to Pajot, the best foot to seize is the one which can be held best and most firmly.[1] Many complicated and ingenious diagrams have been drawn to show that version is always easy if done by the author's method, but difficult or impossible if done by any other. Notwithstanding the diagrams, however, version can be successfully performed in many different ways. In unsuccessful cases, no doubt, the *post-hoc propter-hoc* argument has been frequently employed, and want of success attributed to seizing the wrong foot or introducing the wrong hand, rather than to its rightful cause. Traction is sometimes made too far forward, and then the free foot is apt to be thrown across the symphysis, preventing further descent. The anterior hip and foot are the ones which usually give trouble. If rotation does not take place when traction is made upon the foot or knee which has been brought down, the other one must be found and drawn down also. Before commencing the search for the second foot a noose should be slipped over the first one to keep it under control. If it is found difficult to grasp the second foot firmly enough to make traction upon it, a noose should be slipped over it also. The application of a sling is not always such a simple matter as might be supposed. When the foot is at the vulva or in the anterior portion of the vagina it is easy enough to pass the filet over the ankle, but when the foot remains in the upper part of the vagina it is sometimes a very difficult matter, and one of the following methods must then be adopted: With a piece of broad strong tape a running loop is made and slipped over the left wrist; the left hand is passed into the vagina, seizes the foot, and draws it down as far as possible; the loop is then pushed up over the left hand by the fingers of the right till it surrounds the child's ankle completely; the ends of the loop are then tightened and a firm hold is obtained. When the vagina is not large enough to allow the fingers of the right hand to execute this manœuvre, the loop must be carried up by means of a repositor: Braun's is the simplest and best, consisting of a flexible rod sixteen or eighteen inches long, with an eye two inches from its upper end. The running loop is prepared and slipped over the left wrist as described above: it is then secured to the repositor in the manner shown in Fig. 84 and carried up to the desired position. An ordinary gum-elastic male catheter would serve the purpose quite as well: it may be used without a stilette, as in Figs. 85, 86, or with it, as in Figs. 87, 88. A long pair of dressing, uterine, or polypus forceps occasionally succeeds when other means fail.

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[1] "Le pied qui est le bon, est celui qui l'on tient le mieux et le plus solidement."

If the second foot is beyond reach, or if traction upon both limbs does not cause the fœtus to rotate, an attempt should be made to dislodge the impacted shoulder. Crutches and various other mechanical appliances have been devised from time to time to aid in accomplishing this result, but the hand is safer and better than any of them. In these cases Goodell recommends bringing down the upper arm and rotating the child on its long axis, or else introducing into the vagina the hand corresponding to the child's head, and gently pushing the presenting part away from the cervix. The longer the waters have drained away, the more difficult it becomes to turn and the more liable is the uterus to rupture. If rupture is feared, the patient should be kept well under an anæsthetic and manipulation practised with the utmost gentleness and patience. The external hand is of great service in steadying and supporting the uterus during the operation and aiding in the descent of the breech. If gentle manipulations fail to accomplish version, it is safer to desist from further attempts and resort at once to embryotomy or decapitation.

FIG. 84.

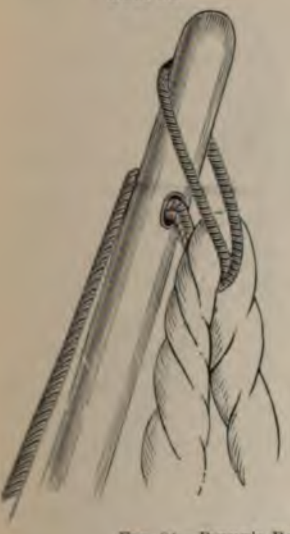

FIG. 85.

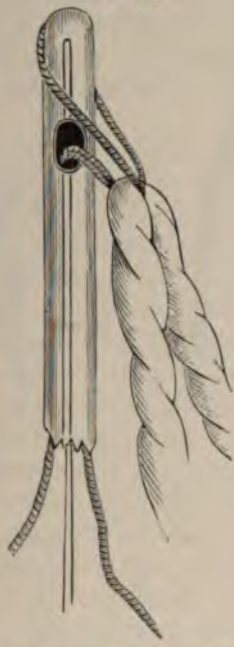

FIG. 86.

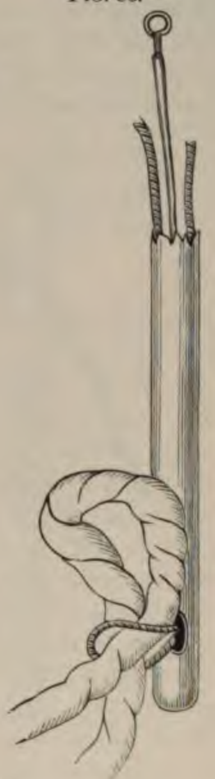

FIG. 84.—Braun's Repositor, arranged as a noose-carrier.
FIG. 85.—Male Gum-elastic Catheter, used as a Braun's repositor.
FIG. 86.—Another Way of Using a Male Catheter as a Noose-carrier.

In *cephalic presentations* the operation is practically the same as in transverse. After a foot or knee has been seized, it sometimes happens that rotation is prevented by the head remaining in the pelvic brim. If not too firmly wedged it may be dislodged by the thumb pushing up the head, while the index and middle fingers pull down the foot, or a sling may be passed around the ankle and traction made upon it while the hand endeavors to push back the head. If one foot can be brought down only partially, and version cannot be completed till the other is secured, a noose should be applied above the ankle of the first foot and entrusted to an assistant while search is being made for the second foot. If the feet have become displaced they may be readily found by passing the hand along the child's back and thighs as a guide. If they lie anteriorly above the hypogastrium, the symphysis will prevent their being reached by the hand as long as the patient is in the dorsal position; but in the lateral or knee-elbow position there will be no difficulty.

FIG. 87.

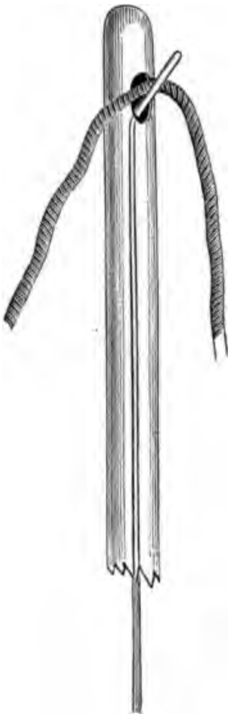

FIG. 88.

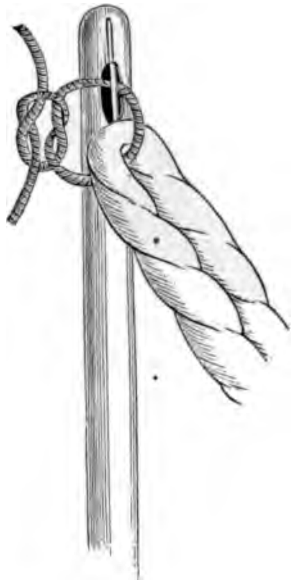

FIG. 87.—German Method of Using a Male Gum-elastic Catheter as a Noose-carrier: the stilette is made to protrude from the eye, and a small cord slipped over it.

FIG. 88.—The Stilette, pushed home, holds the cord: when the noose is to be set free the stilette is withdrawn.

During the first stage of labor, while dilatation of the os is still going on, version may be performed easily at any time; but when dilatation is complete and the expulsive stage has begun, the liquor amnii may come away suddenly at any moment, and the uterus contract about the fœtus so as to make version difficult or dangerous. While it may be well to refrain from operating during the stage of dilatation, it is bad practice to delay when the expulsive stage has once begun. Winter strongly recommends waiting till the os is dilated or dilatable, so that version may be immediately followed by extraction. He claims that the child's chances will be improved thereby, because there will be less risk of—(1) the cord being injured or compressed; (2) air entering the uterus, causing tympanitis uteri, which is fatal to the child; (3) premature separation of the placenta. In transverse presentations version should be performed as soon as the os is soft and dilatable, for it must be remembered that in such cases full dilatation of the os does not usually take place, especially if the waters have come away.

Should extraction immediately follow version?

From an analysis of 310 uncomplicated cases of transverse presentation which occurred in the Berlin Clinic between 1876 and 1884, Winter[1] concluded—(1) that version should not be performed till the os is sufficiently dilated to permit of extraction; (2) that the best results for the child are secured when extraction immediately follows version. Dohrn[2] of Königsberg accepts the first of Winter's propositions, but not the second, and contends that the interests of mother and child are best secured by the spontaneous expulsion of the fœtus, and that extraction should be performed only for definite indications. He says that when extraction immediately follows version the position and rotation of the fœtus are apt to be different from what they would have been in spontaneous delivery, and claims that the natural coaptation of the fœtus to the parturient canal is less dangerous than the artificial. In 152 cases in his clinic in which extraction immediately followed version 22 children were lost, while in 29 cases delivered spontaneously after version there was not a single fœtal death. Upon the whole, continental opinion so far seems to side with Winter and Schroeder, and the teachings of the Berlin School guide practice in this respect.

SOME DIFFICULTIES AND DANGERS.

Capping of the Fundus.—Turning is both difficult and dangerous when with strong uterine action there is hindrance to the passage of the child, such as a transverse position or contraction of the pelvis. The muscular corpus, unable to overcome the hindrance, contracts and pulls itself up till nearly the whole body of the child is left enveloped in the stretched and thinned lower segment and cervix. Rupture of the uterus is then very liable to occur, especially if attempts be made to perform version.

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[1] *Zeitschrift f. Geburtshülfe und Gyn.*, Bd. xii.

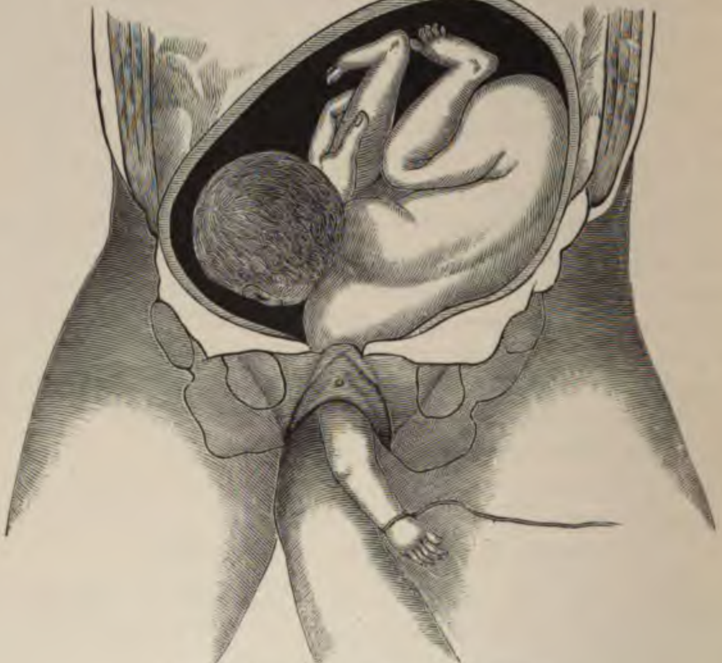
[2] *Ibid.*, Bd. xiv. S. 72.

Tetanus uteri, as it is sometimes called, is occasionally produced by the injudicious and untimely use of ergot. The uterus is in a state of tonic contraction, and grasps the child so tightly that the hand cannot be passed up to reach a foot or knee. At one time bleeding was the favorite means of relaxing the uterine muscle; hot baths and opium were sometimes employed for the same purpose; but at the present time chloroform and gentle continuous pressure are preferred. The patient being first deeply narcotized, the hand is pressed carefully past the presenting part, and the tetanic contraction of the uterus gradually overcome by patient manipulation. In most cases version can then be performed.

Œdema of the vulva is sometimes a serious impediment, and if undue pressure be made upon the soft parts gangrene may result.

Obstructions in the cervix, such as undue rigidity, incomplete dilatation, spasmodic contraction, placenta prævia, etc., may render version difficult. The means usually recommended for the relief of such conditions are the inhalation of chloroform, opium, or alcohol internally, hot baths and douches, the application of cocaine solutions to the cer-

FIG. 89.

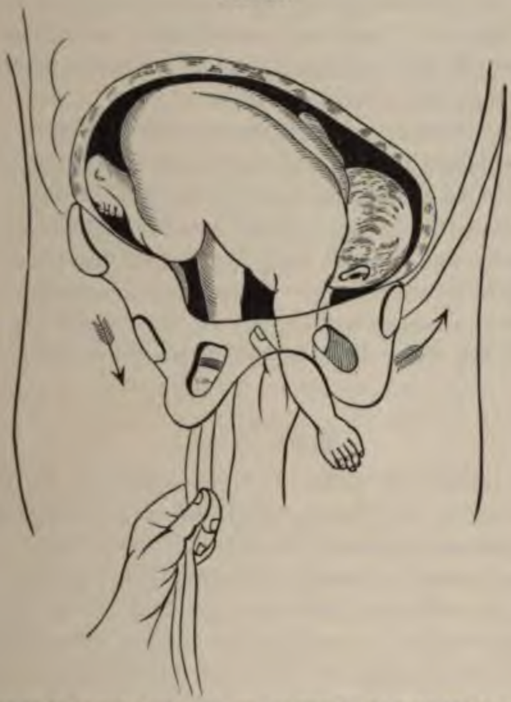


Podalic Version when an Arm is Prolapsed.

vix, a weak faradic current, dilatation manually or by rubber bags, and, as a last resort, multiple incisions of the external os.

Prolapse of the arm in transverse positions used to be considered a serious impediment to version, and many ingenious manœuvres were suggested to reduce it.[1] Louise Bourgeois (1609) dipped the arm in cold water to make the child draw it back again into the uterus, or greased it well with melted butter and tried to push it back. When the arm was livid and swollen and could not be replaced, some obstetricians did not hesitate to amputate it. Nowadays prolapse of the arm is not considered a disadvantage; indeed, it is sometimes of use in enabling the attendant to arrive at a correct diagnosis of the child's position in utero.[2]

FIG. 90.



Method of Lifting an Impacted Shoulder from the Brim: The right hand lifts the shoulder, while the left pulls down the leg by means of a sling (Barnes).

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[1] Saint-Germain advised putting ice in the child's hand. Deventer speaks of pinching and filliping it, so that the child might be made to draw its arm back. Albucasis, Burton, and others invented crutches, forks, and repositors to push it back, and in the event of failure pulled the arm off. Philumenes disarticulated it. Aetius said it should be cut, torn, or twisted off. Guillemeau drew it down as far as possible, and then amputated it. Mauriceau advised twisting it, as one would the branch of a tree which he wished to extract from the ground. Josephi used to scarify the swollen part deeply, so as to reduce its bulk.

[2] When the waters are away, and there is any doubt about the diagnosis of the

Deventer (1701) was the first to show that reposition of the prolapsed arm is unnecessary, while De la Motte (1721), Levret (1749), Puzos (1753), and others proved it to be inexpedient as well as unnecessary. When the arm is prolapsed a noose of tape should be fastened to the wrist and held moderately tight by an assistant while version and extraction are being performed (Fig. 89). The tape enables the arm to be drawn out of the way of the operator's hand, and prevented from rising beside the child's head and complicating extraction. The swelling and lividity of the prolapsed arm are no index of the child's condition as to whether it is living or not.

Impaction of shoulder is a very serious complication. Version may sometimes be effected by a sort of bipolar manœuvre. A noose having been fastened to the child's ankle, the impacted shoulder is pushed up with one hand, while the leg is drawn down with the other (Fig. 90). Traction should not be made upon the leg till the shoulder has been somewhat lifted from the brim. Decapitation or embryotomy may be the only means of effecting delivery if the shoulder has been long impacted and the uterus has become moulded to the contour of the fœtus.

EXTRACTION.

Anæsthesia.—Opinions differ as to the value of anæsthetics during the stage of extraction. Some object that they weaken the pains and prevent the patient from rendering intelligent assistance. Others claim that such disadvantages are more than counterbalanced by the increased relaxation of the soft parts and the ease with which the hand can be passed into the vagina to perform the needful manipulations. It is maintained, moreover, that an intelligent assistant, making firm pressure upon the fundus, can apply an amount of *vis a tergo* not to be expected from the voluntary efforts of the patient herself.[1]

In easy cases an anæsthetic is seldom required, but when there is much difficulty or delay deep anæsthesia is found to facilitate extraction and diminish the risks of both mother and child. The anæsthetic need not be given till it is time to liberate the arms and deliver the after-coming head.

Position of Patient.—In version proper the lateral position is often better than the dorsal; but in extraction the dorsal is usually preferable. The patient is placed on her back across the bed, with hips raised on a pillow and brought well over the edge of the bed (or ope-

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child's position, Murphy recommends bringing the hand outside the vulva. It can then be readily seen whether the hand is right or left, and when supinated its palm will correspond to the child's abdomen (*Murphy's Lectures*, 2d ed., p. 391).

[1] Delivery of the after-coming head by means of *expression* was the routine treatment from the time of Celsus (B. C. 30) down to that of Puzos (1573), when the so-called *Prague* method was first described.

rating-table). The knees are held by two assistants, one of whom has been instructed how to support the fundus during extraction and make firm downward pressure when required. Another assistant administers the anæsthetic.

Method of Extraction.—For the sake of convenience three stages are usually described: 1. Extraction of the trunk as far as the shoulder-blades; 2. Liberation of the arms; 3. Delivery of the after-coming head.

1. *Extraction of the Trunk as far as the Shoulder-blades.*—The foot[1] which has been brought down into the vagina during version is seized by the right hand and traction[2] made in the axis of the brim. The limb which is pulled upon always turns in the direction of least resistance—*i. e.* to the front. As the leg emerges from the vulva it is wrapped in a warm napkin and grasped as high as possible, the thumb being directed upward and applied to its dorsal aspect. Traction is continued in the axis of the brim till the breech comes down upon the pelvic floor and begins to press upon the perineum; traction should then be directed more forward and upward. As the breech emerges from the vulva one or two fingers of the left hand may be hooked into the groin to give greater tractile power and at the same time lessen the strain upon the leg.[3]

When the legs have cleared the vulva, either the pelvis may be grasped by both hands or the legs may be held by one hand and the pelvis by the other. Traction is again directed backward in the axis of the brim. When the cord comes in sight it is drawn down[4] and placed where it will be least likely to suffer injury[5] or compression.[6]

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[1] If both feet have been brought down during version, they should both be grasped by the right hand, the middle finger being inserted between them.

[2] Barnes insists that only *traction* should be used, and that all attempts at artificial *rotation* should be avoided. He directs the limb to be held loosely, so that it may rotate along with the trunk, and not in any way obstruct normal rotation.

[3] Dr. Matthews Duncan has proved by experiment that either leg is stronger than the neck, and can bear a stronger pull. Any tractile force that is safe for the neck is safe for the leg (*Mechanism of Natural and Morbid Parturition*).

[4] It should always be drawn down from the placental side, never from the fœtal.

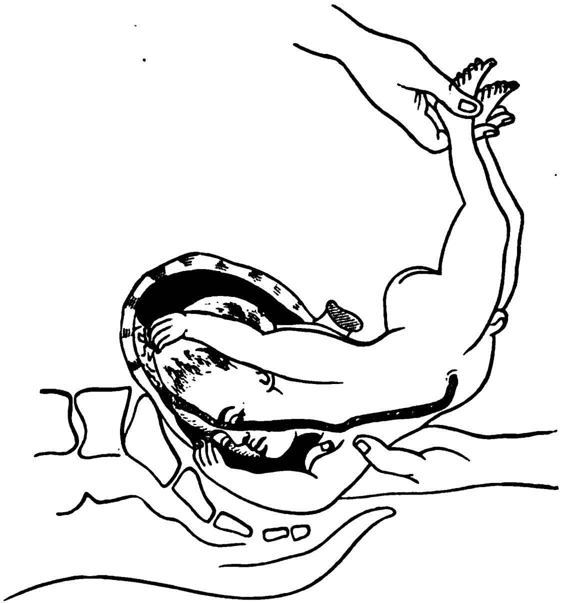
[5] It occasionally happens that the child bestrides the cord; if possible, the cord should then be drawn down and slipped over the posterior thigh. If this cannot be done, it should be tied in two places and cut between the ligatures, and the child delivered as soon as possible. Time may be saved by applying a couple of Péan's forceps instead of the ligatures. Occasionally the cord is so short that it has to be ligatured and cut before labor can be terminated.

[6] Wigand, Ritgen, and others say that pressure upon the cord affects the veins more than the arteries, and that consequently the *ingress* of blood is more impeded than the *egress*; pressure therefore tends to produce anæmia, which if prolonged may prove fatal. It is recommended to ligature and cut the cord as soon as it can be reached; and Ritgen says that there is then little need to hurry extraction. It is now, however, pretty generally admitted that in such cases *asphyxia* is the cause of fœtal death, and not *anæmia*: Ritgen's advice is therefore misleading.

Up to this stage extraction has not been hurried, in order that the soft parts might have time to dilate; but now every moment is precious, and delivery must be completed as rapidly as possible.[1] The assistant henceforth maintains firm pressure upon the fundus to keep the uterus well contracted about the fœtal head and shoulders. Thereby hemorrhage is avoided, and the arms are kept so closely applied to the body that they cannot be displaced and pushed up over the head. During this stage, unless rapid extraction is specially indicated, traction should not be made in the interval of the pains, for fear of displacing the arms upward.

2. *Liberation of the Arms.*—As soon as the shoulder-blades begin to appear traction is discontinued and the arms liberated. Normally, they are flexed and folded across the breast, but by undue or ill-timed traction, or by neglect to support the fundus, they may be displaced above or beside the head. When in their normal position the liberation of the arms is easy, but when they are displaced upward it may be very

FIG 91.



Method of Liberating the Posterior Arm when both arms have become extended beside the head (Barnes).

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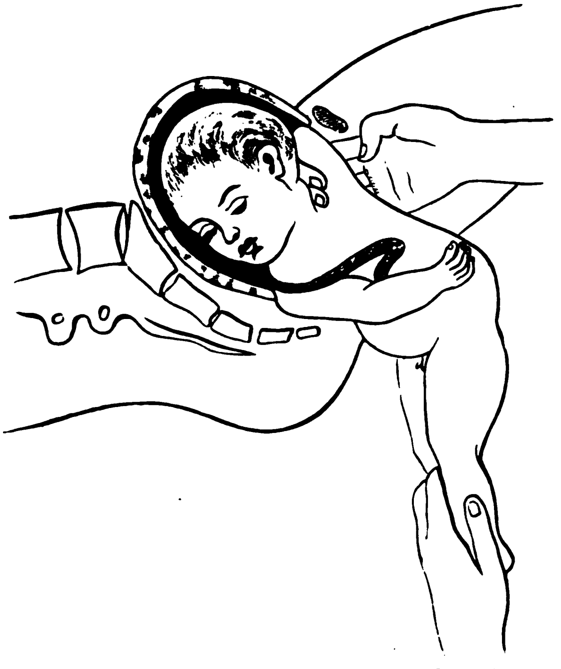
[1] Before the delivery of the breech and legs the placental circulation is unimpaired and delay does not harm the fœtus: but after their delivery the bulk of the uterus is so much reduced that the placental circulation is disturbed and inspiratory efforts are apt to be made. Fluids and other foreign bodies may thereby be drawn down into the respiratory passages, causing either fatal asphyxia at once or fatal inflammatory mischief in a few hours or days.

difficult. The posterior arm is generally easier to reach than the anterior, and is therefore usually brought down first. To accomplish this the body of the child is carried well up to the front around the symphysis pubis; the posterior shoulder is thereby brought within reach and more room afforded for manipulation. Two fingers are passed along the side and back of the child up over its posterior shoulder, till they can be hooked over the humerus; the arm is then easily carried with them across the face and the forearm drawn down over the breast (Fig. 91). If this manœuvre fails, the operator may withdraw his hand, and, passing the other one along the child's abdomen, attempt to bend the posterior elbow toward the anterior pelvic wall. The posterior arm having been delivered, the child's body is carried well back over the perineum and the anterior arm released by a similar manœuvre (Fig. 92). If there is not room enough to deliver the anterior arm beneath the symphysis, the liberated arm should be seized and drawn up toward the symphysis: the anterior arm will then probably rotate backward into the hollow of the sacrum. If the child's back points to the left, the free arm should be raised along the left labium; if to the right, along the right. The second arm may be then delivered in the same way as the first.

FIG. 92.



Method of Liberating the Anterior Arm (Barnes).

The following manœuvre sometimes succeeds when others fail: grasp the child's body above the hips and rotate it upon its long axis till the back is brought a little to the left; the *pubic* arm, not being able to follow the rotation of the trunk, is thrown somewhat across the chest, where it can be more easily reached; then rotate the body as much in the opposite direction in order to bring the *sacral* arm within reach: only gentle manipulation is permissible; violent rotation may twist the child's neck. Occasionally the anterior arm is displaced backward (*nuchal* or *dorsal* displacement) and the forearm thrown across the neck; if traction is now made the displaced arm is jammed between the occiput and symphysis pubis. This very awkward complication is usually the result of improper manipulation. If possible, the posterior arm should first be released, and an attempt then made to rotate the anterior arm into the hollow of the sacrum. If the posterior arm cannot be released, the body should be carried well back over the perineum and an attempt made to pass a fore finger between the symphysis and the child's shoulder so as to draw the elbow downward and forward. If all manipulative efforts fail, the axis-traction forceps should be applied and delivery effected even at the risk of fracturing the humerus.[1] If forceps fail, craniotomy must be performed.

The shoulders usually enter the pelvis in the oblique diameter already traversed by the hips; occasionally, however, they enter in the transverse. In such event, if the arms remain flexed and in their normal situation, they are easily liberated; but if allowed to extend, the trunk should be rotated so as to throw one arm back into the hollow of the sacrum, where it can be more easily seized and brought down.

3. *Extraction of the Head.*—After delivery of the arms, if the fundus has been properly supported, the head will be found to have entered the pelvis in a position moderately flexed or straight, rarely extended. Extraction of the head may be effected *manually* or by *forceps;* in the great majority of cases the manual method is quite sufficient, and is therefore to be preferred.

(1) *Smellie's Method.*—The child's body having been wrapped in a warm napkin and supported upon the palmar aspect of the left arm, the index and middle fingers of one hand are passed into the vagina and applied one on each side of the nose; the fingers of the other hand press the occiput upward. As the head flexes traction is made and the trunk raised (Fig. 93). This method aims to produce flexion of the head upon the trunk by traction upon the superior maxilla and pressure upon the occiput applied alternately or simultaneously. It is applicable

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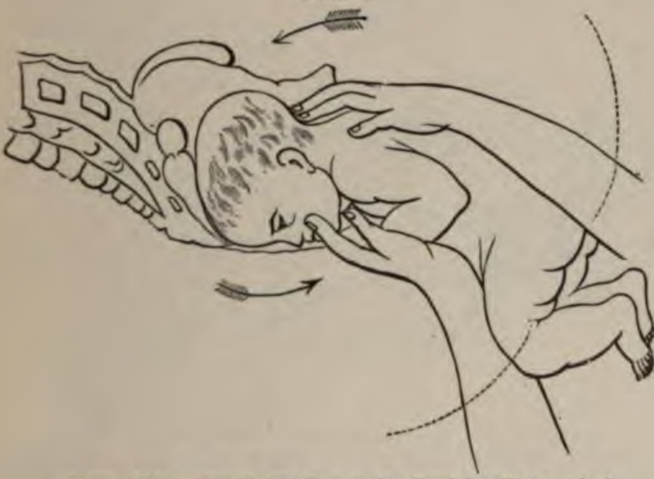
[1] If fracture occurs, the ends of the bone should be approximated, and a short anterior and long posterior pad bandaged to the arm. Better union will be obtained if the arm is bandaged to the body. The friends should always be informed beforehand that racture is apt to occur.

only to easy cases, where there is no disproportion between the pelvis and fœtal head. In difficult cases no time should be wasted with this method.

(2) The *Smellie-Veit Method*, called also *Mauriceau's*, *Levret's*, or *Veit's*[1] method, consists of combined traction upon chin and shoulders.

FIG. 93.



Manual Extraction of the After-coming Head, Smellie's method.

If Smellie's method has been tried without success, the fingers are removed from beside the child's nose and passed into its mouth,[2] while those of the other hand are slipped down and hooked over the shoulders (Fig. 94). Downward traction is then made with both hands, care being taken to pull mostly upon the shoulders, so as to avoid injuring the jaw. As the head descends the trunk is raised; the occiput is pressed upward by the resistance of the symphysis, and the face, rotating downward over the sacral hollow, emerges from the vulva. This method is safer and surer than *Smellie's*, the combined action of the two hands tending to prevent injurious twisting of the trunk upon the head.

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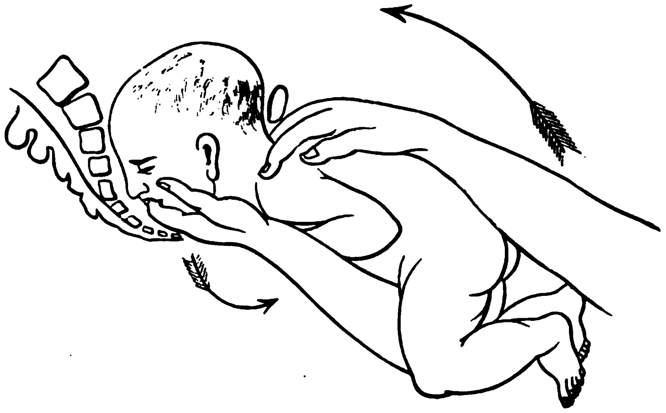
[1] Mauriceau described this method in 1668; he was the first to recommend the fingers to be passed into the child's mouth and downward traction made on the lower jaw. His method was modified by Smellie and Levret, and used by them in preference to all others. By Schroeder it was called "the Smellie-Veit Method," and in Germany it is now called by many "Veit's Method," because Veit's writings have been mainly instrumental in reinstating this mode of manual extraction. Formerly, in nearly all difficult cases the forceps was used in Germany to extract the after-coming head, but now it is seldom employed except where pelvic contraction is considerable.

[2] If much resistance is offered to the descent of the head through the brim, it may be found difficult or impossible to flex the head upon the trunk by means of the *Smellie-Veit* method; for when traction is made the chin can be pulled down upon the chest, but the head fastened in the brim refuses to follow. In such a case it would be better to combine the two methods: first secure good flexion by the *Smellie* method, and then deliver by the *Smellie-Veit*. If the head tends to extend during extraction, the fingers had better be kept applied to the upper part of the face, and not introduced into the mouth at all.

When the head enters the pelvis in the transverse diameter, traction usually makes the occiput turn toward the front; but occasionally this does not happen, and the occiput rotates to the sacrum, while the forehead comes down against the symphysis. The margin of the perineum becomes then the fulcrum instead of the symphysis, and downward traction makes the neck pivot upon the perineal border, while the forehead sweeps out under the pubes.

FIG. 94.



Manual Extraction of the After-coming Head: combined traction upon mouth and shoulders. Veit's method.

If the head is arrested at the brim, the extraction is far more difficult and the life of the child placed in greater peril: much, then, depends upon the intelligent help of the assistant in charge of the fundus.[1] A strong *vis a tergo* facilitates extraction and allows the operator free use of his hands to direct the passage of the head through the pelvis. Time should not be wasted with Smellie's method, but the Smellie-Veit should be tried at once. In most cases it will succeed, but if it fails the Prague manœuvre should be tried.

(3) *Prague Method.*[2]—The fingers of the left hand being hooked over the nape of the neck, the right hand grasps the child's feet, and the

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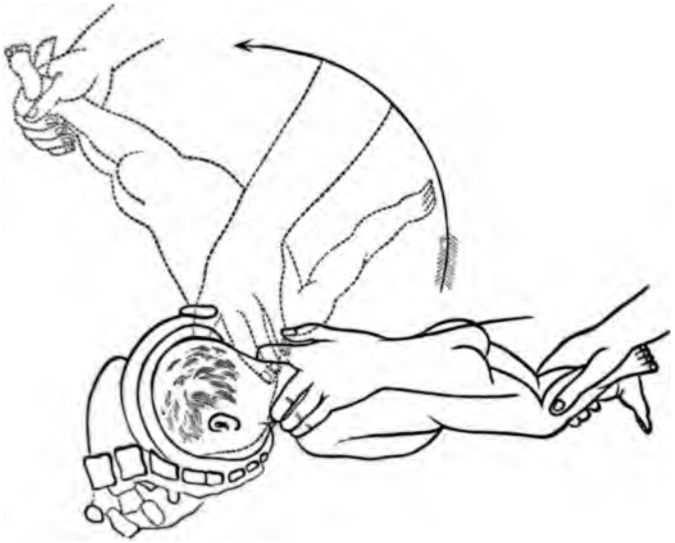
[1] In making pressure upon the fundus force should not be applied equally over the entire head, but should be concentrated more upon the forehead, in order to push it down into the cavity and promote flexion.

[2] This method was fully described by Puzos (1573), and put forward by him to replace the old classic method of delivery by expression. It did not come into general use till resuscitated by Kiwisch in 1846. Unimportant modifications were suggested by Braun (1857) and Scanzoni (1864).

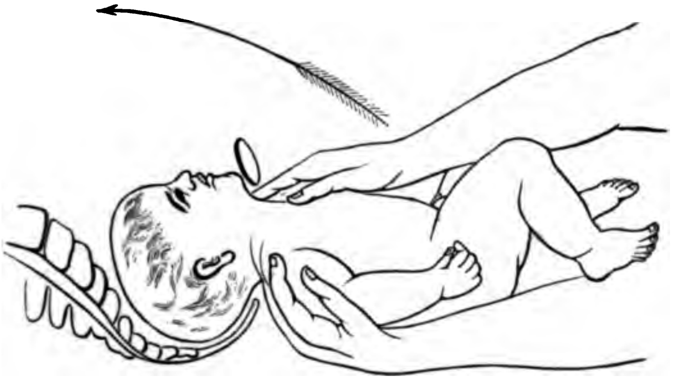
body is swept as far back as possible over the perineum; traction is then made vertically downward with both hands, care being taken meanwhile to maintain pressure upon the fundus. As the head slips down into the pelvis, the feet are rapidly raised toward the mother's abdomen, the neck pivots upon the fingers of the left hand, and the head is shelled out of the pelvis (Fig. 95).

FIG. 95.



Manual Extraction of the After-coming Head. Prague method.

FIG. 96.

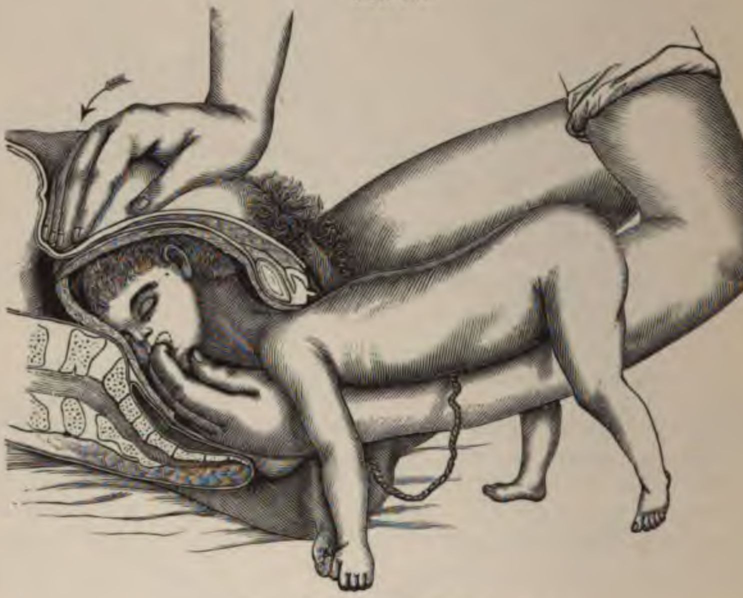


Method of Extraction when the Chin is Arrested at the Symphysis (Chailly-Honoré).

If the head is extended, the chin pointing forward and arrested at the symphysis, while the occiput lies in the hollow of the sacrum, the body of the child should be carried upward during traction and the occiput made to rotate over the perineum (Fig. 96).

(4) *Wigand-Martin*[1] *Method.*—This method consists of combined extraction and expression. The hand whose palmar surface, when midway between pronation and supination, corresponds to the abdominal surface of the child is passed into the vagina along the posterior wall until the tips of the first and second fingers reach and are inserted into the child's mouth; a firm hold is taken on the lower jaw, by which the head can be flexed and drawn down. The other hand seizes the occiput through the abdominal walls and exerts powerful pressure in the direction of the axis of the superior strait. By this method, Winckel says, "one can bring the head of a full developed child through a conjugate diameter of only 6 cm. in the short space of 15–75 seconds." "For this reason," continues Winckel, "the method will surely in a short time displace all others."

FIG. 97.



Wigand-Martin Method (Winckel).

(5) *Forceps.*—Manual extraction having failed, the forceps should be tried as a last resort. Considerable difference of opinion exists as to the utility of the forceps in the delivery of the after-coming head. Advocated strongly by such men as Smellie, Busch, Rigby, and Meigs,

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[1] See Wigand, *Beitrage zur theor. und prakt. Geburtshülfe*, Heft 2, Hamburg. 1800; Mme. Lachapelle, *Pratique des Accouchemens*, Paris, 1821, t. i. pp 337, 338; K. Ruge, *Zeitsch. f. Geburtsh. u. Frauenkr.*, v. E. Martin, i. p. 82, 1876; Champetier de Ribes, *Du passage de la tête fœtale à travers le détroit supérieure rétréci du bassin*, 1879; A. Martin, *Berl. klin. Wochenschrift*, 1886, p. 660; Winckel, *Verhandl. des II. Gynäk. Congress*, Halle, 1888, and *Lehrbuch der Geburtshülfe*, Leipzig, 1889, pp. 683–686.

and in later times by Barnes, Cazeaux, Tarnier, Charpentier, and others, the forceps operation is opposed with equal vehemence by an influential section of the German school. Schroeder used to say that the introduction of the forceps has cost many children their lives and brought discredit upon podalic version. Whatever difference of opinion may exist as to its value in ordinary breech cases, this instrument is undoubtedly of service after version in some cases of contracted pelvis. I am sure that I have seen children safely delivered by means of forceps who would otherwise have perished, and I am equally sure that I have seen children allowed to asphyxiate who might have been saved by a timely use of the forceps. Some form of axis-traction forceps should be employed: the best models are those of Tarnier, Breus, and Poullet. Forceps will be found most useful when the head is arrested at the brim, owing to disproportion between the pelvis and fœtal head. The long diameter of the head usually corresponds to the transverse of the brim; if the blades are applied in the roomiest part of the pelvis, they will grasp the head in its long diameter[1] and easily draw it down into the cavity. Some recommend applying the blades to the sides of the child's head, so that the biparietal diameter may lie in the grasp of the instrument; but the conjugate of the brim is already too narrow to permit the easy passage of the biparietal, and if this latter diameter is still further increased by the width of the forceps-blades, its passage will be rendered still more difficult.[2] The forceps saves the child from the dangers of too great rotation of the head upon the trunk and undue dragging upon the spinal column. It should usually be applied to the abdominal aspect of the child. If the occiput lies anteriorly, the body is drawn well up over the pubes to give sufficient room for the application of the blades (Fig. 98). If the occiput lies posteriorly, the head may be found either flexed or extended. If flexed, the body is carried down over the perineum and the forceps introduced under the symphysis (Fig. 99); traction is made downward and backward, to increase flexion and deliver the occiput posteriorly over the perineum. If the head is extended and the chin behind the symphysis, the forceps may be applied either along the child's *abdominal* or *dorsal* aspect (whichever can be done most easily), and the head made to pivot upon the submental region. Some recommend removing the forceps when the head has been brought down into the cavity, and completing delivery by the manual method. There is nothing to be gained by so doing, but, on the contrary, valuable time may be lost: it is better, therefore, to complete delivery by means of the forceps.

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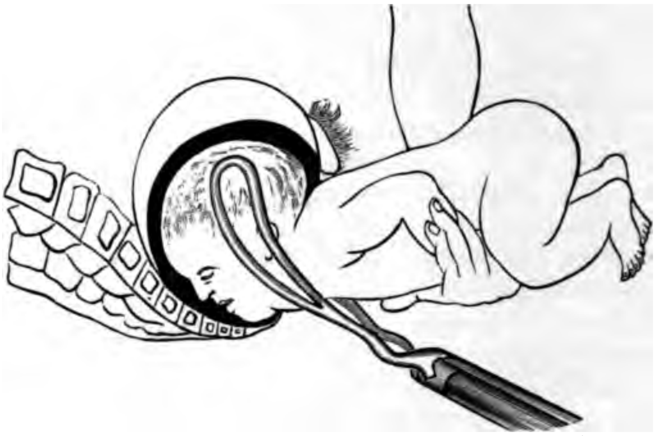
[1] Practically, the blades do not grasp the head exactly in its antero-posterior diameter, but in an oblique direction intermediate between the antero-posterior and transverse.

[2] It is argued by the advocates of this plan that lateral compression is more apt to overcome disproportion by increasing the antero-posterior measurements at the expense of the lateral, and that compression antero-posteriorly is apt to increase the disproportion by bulging out the head laterally. Though theoretically plausible, practically this view is incorrect; for experiments have abundantly shown that when the forceps-blades are applied at the sides of the pelvis (where there is most room), the head is moulded upward in the direction of least resistance, and not laterally, where it encounters the resistance of a narrow conjugate.

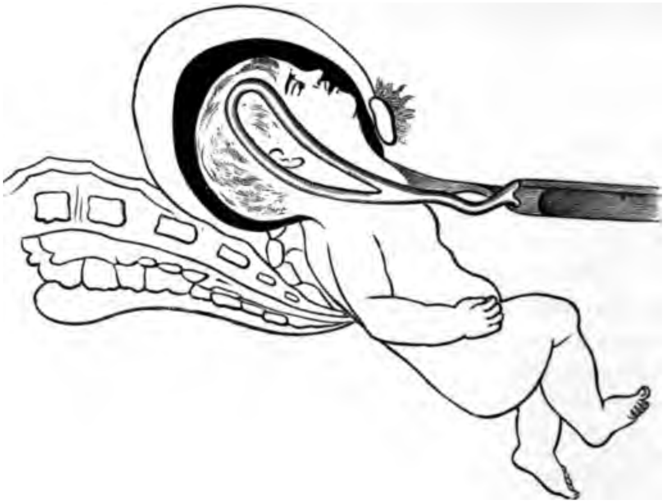
FIG. 98.



Forceps Delivery of the After-coming Head in dorso-anterior positions.

When the head is prevented from descending by stricture of the os or cervix or contraction of the cervix around the child's neck, the forceps will be found particularly useful. It rapidly dilates the constricted cervix and delivers the head with comparatively little force, whereas when the manual method is employed traction upon the child's body

FIG. 99.



Forceps Delivery of the After-coming Head in dorso-posterior positions.

serves only to drag the uterus down toward the vulva. Whichever method is adopted, laceration of the cervix is apt to occur; it is advisable, therefore, to examine carefully after the placenta has come away, and if deep laceration exists to apply silk or worm-gut sutures. Chloroform is essential in such cases. Depaul recommends dilatation of the cervix by the fingers before delivery is attempted, and if that fails incision of the cervix.

Time is the great element in safe delivery after the cord has come into view. If the head is not delivered within four to eight minutes, the child will probably be stillborn or else deeply asphyxiated.[1] Exceptionally, children have survived fixation for fifteen minutes. If the child breathes, foreign bodies are apt to be drawn down into the air-passages, causing asphyxia at once or lobular pneumonia in a day or two. Attempts have been made to obviate asphyxia by trying to supply the child with air artificially. Pugh recommended passing two fingers into the mouth and allowing air to enter along the hollow of the hand. Weidmann conveyed air into the mouth by means of a catheter or special tube prepared for the purpose (*vectis aërophorus*).

In difficult cases there is no time to waste, for the child should be delivered in four or at most five minutes after the liberation of the arms. It is well to adopt in all such cases a certain routine, and have each stage of the operation accurately timed, since it is very difficult for an operator in his hurry and anxiety to gauge correctly the lapse of time. Not only should all instruments be prepared beforehand and placed within easy reach, but whenever possible the plan of operation should be explained to the assistants and minute instructions given them as to what they are expected to do. Coolness and presence of mind on the part of the operator beget confidence in the assistants and secure prompter service. When manual extraction is to be tried in a difficult case the Smellie-Veit or Wigand-Martin method should first be practised; if that fails, the Prague method. In the great majority of cases one or other of these will succeed; but if steady manipulation for two, or at most three, minutes fails to deliver the head, no more time should be wasted: the forceps should be applied without delay. It is not then a question as to whether manipulative efforts might not after a time succeed in delivering the head, but whether they will succeed soon enough to save the child. Forceps sometimes fails to save the child's life because its application is deferred too long; the child has already become asphyxiated during long-continued and fruitless manipulative efforts; the want of success cannot then be fairly attributed to the forceps.

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[1] Hodge pointed out that asphyxia caused by the separation of the placenta from the uterus before the delivery of the child's head is a more frequent cause of fœtal death in breech cases than pressure upon the cord. He says: "This seems to me by far the most frequent reason why children so often perish in pelvic deliveries, and why so little confidence should be placed in attempting to remove the cord from pressure" (*Am. Journ. of Obstet.*, May, 1875).

VERSION VS. FORCEPS.

For ages, version was the only conservative means of terminating labor artificially, but after the invention of the forceps its sphere became greatly circumscribed. Since the principle of axis traction has been carefully worked out, and the mechanical construction of the forceps improved, it has become possible to deliver the head presenting at the brim with comparatively little risk. The perfecting of the high-forceps operation has given an impulse to external cephalic version, so that in many cases where formerly podalic version would have been performed external cephalic version is now practised, and labor terminated by the high-forceps operation. In Germany version is still the favorite operation, but in France the axis-traction forceps has greatly circumscribed its domain. In England and America deformity of the pelvis is far less common than on the Continent, and dystocia is more frequently due to impediments at the outlet than at the brim. Placenta prævia, also very common in Central Europe, is comparatively infrequent on this continent. Hence, except among the immigrant population, version is comparatively rare, while forceps are used so frequently that America has been aptly styled the home of the low-forceps operation.

As a general rule, when the child is of moderate size, the forceps should not be used

in the *simple flat* pelvis with a conjugate of 3 in. (7.6 cm.) or under,[1]
" *generally contracted* . . . . . 3¼ in. (8.2 cm.).

The nearer the conjugate approaches to these limits the more dangerous the forceps operation becomes, and the more clearly is version indicated. A conjugate of 2¾ in. (7 cm.) may be considered the lowest limit of version.

Except in cases of considerable pelvic contraction the forceps operation may be regarded as comparatively harmless in skilled hands, while internal version is always a serious undertaking, involving more or less danger for mother and child even when performed with the greatest skill. The unpractised operator is far less likely to do harm with the forceps than with version. Whenever, then, it comes to be a question of choosing between forceps and internal version, the forceps should be selected unless specially contraindicated, because the operation will be easier and at the same time safer for mother and child.

Since septicæmia is the chief cause of maternal danger after version, the more thoroughly we adopt antiseptic measures the more favorable will be our results. There really seems to be no good reason now why the risk of maternal injury from septic absorption should not be reduced to a minimum.

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[1] Exceptionally, the high operation with axis-traction forceps will succeed in the most unpromising cases. Some time ago I succeeded in delivering with forceps a living full-term child through a conjugate of 7.5 cm. when version was impossible.

As version is an operation which the general practitioner seldom needs to perform, he is very apt to forget its technique. It would be impossible here to describe all the different manœuvres which sometimes prove useful in complicated cases, and it would be equally impossible for the practitioner to remember them. He should never forget, however, that an exact diagnosis is far more important than a theoretical knowledge of operative methods if he would perform version skilfully. When a practitioner is able to map out correctly the position of the fœtus and its relations to the maternal parts, and form a clear mental picture of the same, he will not need to burden his memory with details, but will realize that in every case he has to deal with a mechanical problem whose solution depends upon his knowledge of general principles and the exercise of his own ingenuity and dexterity. The habitual practice of abdominal palpation in his daily work will soon enable him to obtain the diagnostic skill essential to success.

THE CÆSAREAN OPERATION, SYMPHYSIOTOMY, LAPARO-ELYTROTOMY, AND LAPARO-CYSTECTOMY.

By ROBERT P. HARRIS, A. M., M. D.,
Philadelphia.

The Cæsarean Operation, Gastro-hysterotomy, or Laparo-hysterotomy.

In all of the chief languages of Europe, from the *Kaiserschnitt* of Germany to the *taglio Cesareo* of Italy, the commonly accepted title of this operation may be translated the *Cæsar cut*. Possibly the name may have originated in the fabulous story told of the birth of Julius Cæsar, which appears to have had no more foundation than the similar one fabricated in regard to that of Edward VI. of England. How the title became so universal must always remain a mystery; it certainly has no classic origin or history.

The age of the operation is entirely conjectural. As a surgical measure it was first performed upon the dead to save a living child, but at what period is also unknown. Guido di Cauliaco was the first to write about it, and he recommended its performance in the event of a woman dying in advanced pregnancy: he published a surgical work more than five hundred years ago in which he particularly directed that the abdomen should be opened on the left side, "to avoid the liver." The work was long a standard authority.

The earliest operation upon a living woman which we have good reason to credit occurred "about the year 1500" (probably in 1498), and was performed by Jakob Nufer of Siegershausen, canton of Thurgau, in the extreme north of Switzerland (not in Germany, as usually reported), upon his own wife after her case had been considered hopeless by a number of attending midwives and lithotomists. Nufer was a gelder, and probably also a spayer, of cattle, and accustomed to the use of the knife: his wife appears to have been in a critical condition, due probably to the want of skill in her attendants, as the fact that she gave birth naturally to several other children at later periods shows that her pelvis was not deformed. Many authors have doubted the truth of this delivery, for the reason that it was not reported until after a lapse of eighty-two or more years. Now, what are the facts? Dr. Gaspar Bauhin of Basle published the case in 1582 in an appendix to a Latin translation which he made of François Rousset's little work on *Hysterotomotokie*. Gaspar was the son of Dr. Jean Bauhin, formerly of Amiens, France, and was born in Basle on January 17, 1550, his father then being thirty-eight years old. The child delivered from Frau Nufer was a boy and lived to the age of seventy-seven. She bore twins at her next labor in the following year, one of whom, Johann, became a prefect and was living at the age of eighty-three, when Prof. Bauhin reported his mother's case. As there were four other children born later, there was no difficulty in obtaining an account of so remarkable an operation belonging to his own country, which does not appear at all incredible now, when we consider the fact that three midwives have done the same thing—viz. one in Charlemont, Ireland, in 1738,[1] woman saved, child dead; one in Louisiana in 1838,[2] woman and child saved; and one in France in 1881,[3] woman nearly moribund, lost in three days, and child saved. Several operations have been claimed for the fifteenth century—one in 1424—but the records are not considered reliable. Germany's first case was in 1610.

Reasoning analogically from what has occurred in the last two hundred and fifty years, I am inclined to believe that the Cæsarean operation has in all probability a greater age than was even claimed for it by Pliny, or more recently by Jewish writers, whose statements have been discredited by their own medical authorities. If six women[4] have in the last one hundred and nineteen years performed the Cæsarean operation upon themselves, some of whom had never heard of it, is it at all unlikely—or, rather, is it not highly probable—that women in remote ages have sought relief from the pangs of prolonged labor in the same way? If an ignorant Jamaica slave did this with entire success in 1769, is it not probable that history was only repeating itself in her case? Knives, razors, excitable and impatient temperaments and reckless disregard of consequences are as old as the Pyramids of Egypt. What, then, was to prevent the ancients from doing what the moderns have done with such marked success, saving five women out of a record of six cases?

Again, we have another evidence of the probable antiquity of abdominal delivery in the fact that since 1646 there have been no less than eleven women, far advanced in pregnancy, who have been made the subjects of gastro-hysterotomic rips by the horns of the bison, India buffalo, bull, cow, and ox, and that no fewer than eight women and five children escaped death.[1] Horned cattle were so much inclined to do injury by goring in the days of Moses, that he was obliged to enact laws with severe penalties attached, to meet their cases, and a special enactment was made for punishing an ox for goring a woman. No doubt in the early nomadic period just such accidents must have occurred as we find recorded, especially in India, at the present day, where abdominal lacerations by the buffalo are of very common occurrence.

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[1] Radford on "The Cæsarean Operation," p. 196, from *Edinburgh Essays*, vol. v. p. 439.

[2] *New Orleans Med. and Surg. Journal*, vol. xi. p. 13.

[3] *Annales d'Hygiene publiques*, t. ix. 3 S., 1883, p. 108.

[4] *Am. Journ. Med. Sciences*, Feb., 1888, p. 150.

If Macduff was, as he claimed, "ripped out" of his mother's womb, then the instrument of his delivery is much more likely to have been a cowhorn than a knife in the hand of a surgeon; which latter cannot be said to rip out in making the incision. Some early American ovariotomists were derisively called "belly-rippers," but the term "rip" was not intended to be technically correct. One writer in this country states, as if the fact was to be held established, that Macduff had been torn out by the tusk of a wild boar, for which claim there is no historical evidence.

Prof. William S. Playfair in his obstetrical treatise appears to think that Shakespeare's "untimely rip" was indicative of a great age for the Cæsarean operation in the British Isles. After consulting the historic source from which Shakespeare drew his information—viz. *The Chronicles of Englande, Scotlande, and Irelande*, by Raphael Holinshed, London, 1577, in which we find the following: "I am he that the wizzards have told thee of, who was never born of my mother, but was *ripped out*"—I am inclined to interpret the dramatist differently, as already explained. Many a Cæsarean-delivered boy has been named Cæsar or Macduff without due investigation into the claims of either to have been similarly liberated from the uterine cavity. Of the eleven cattle-horn cases, three belong to the credit of the United States, and one each to Mexico, Scotland, India, Holland, Germany, Spain, France, and Italy.

Among uncivilized nations the inhabitants of Uganda in Central Africa appear to be the only people who have been in the habit of performing the Cæsarean operation. This fact was brought to light by Robert W. Felkin, F. R. S. E., of Scotland, who was witness to the performance of a gastro-hysterotomy in 1879 by a native operator upon a young woman, which resulted favorably to her and her child.[2] How old this operation is in Africa it is impossible to determine. It is performed with a considerable degree of skill, and certain steps in it appear to indicate that it is of ancient origin. Thus, before the operator takes up the knife he washes the abdomen and his hands in palm wine, a fluid used extensively in the washing processes of the Egyptian embalmers. Then, again, the abdominal wound is closed by long pins and the figure-of-8 suture, as in operations for hare-lip five hundred years ago. How the *fibula* was used for abdominal wounds in the time of Celsus[1] we are not informed, but it was evidently some kind of pin, to be employed when the tied suture failed to bring the edges of the wound in close apposition. It is remarkable that the African barbarian should be so far in advance of the Chinese and Japanese in operative obstetrics.

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[1] *Am. Journ. Obstetrics*, July, 1887, vol. xx. p. 673; vol. xx. pp. 1033–1036.

[2] *Edinburgh Med. Journ.*, April, 1884, pp. 922–930.

INDICATIONS FOR THE OPERATION.—These may be divided into *imperative* and *relative*. There are conditions, either the result of pelvic deformity, pelvic exostosis, or obstruction by tumors, which render delivery *per vias naturales* absolutely impossible. There are others in which fœtal destruction may accomplish delivery, but at a risk greater than under the Cæsarean operation as it is now performed in Germany. And there are others, again, in which it becomes important to decide between craniotomy and the Cæsarean section, weighing a prospective risk, which may be less under the former, against a somewhat greater danger with a saved fœtus under the latter. If a deformed pelvis is only a little too much contracted to admit of the passage of a living fœtus at maturity either under nature's efforts or by the use of the forceps, craniotomy may be performed with very little danger to the woman; and in the view of a large proportion of obstetricians this is the proper management for a first labor. In case of a second impregnation the rule is to bring on labor prematurely, and thus save the life of the fœtus. But what is to be done in the number of cases, especially among the poor, where they chiefly exist, in which the accoucheur is not consulted until the fœtus is near its full maturity, and in which craniotomy has been already once or several times performed? And suppose, in addition to this, the parents are anxious to have a living child, and the woman, after being informed as to the true risk of the Cæsarean operation, is still willing to run it, is it proper to perform the new laparo-hysterotomy in deference to her wishes and the opinion, which is widely growing, as to the propriety of considering in such cases the rights and interests of the fœtus? With regard to the religious aspect in which such a case may be regarded by a portion of the community, we have nothing to do as scientific obstetricians; but the belief of the mother may be a strong incentive toward submitting to the operation when thought desirable by the accoucheur. Different opinions prevail in different countries as to the extent of pelvic deformity or obstruction which should be encountered before an accoucheur may be considered justified in performing laparo-hysterotomy in place of cephalotripsy and evisceration. In Great Britian, where the mortality has been about 80 per cent. under the abdominal operation, the opposition to its performance, except in very extreme cases, has given the craniotomic alternate in women having a true conjugate of 2½ inches and less a much higher rate of mortality than the improved Cæsarean operation has shown in Germany, where the loss has been 12 in 80. This fact should certainly cause British obstetricians to reconsider an opposition which by reason of a lessening mortality under the knife is becoming more and more groundless from year to year. It may be that there is some danger of the operation becoming too popular in countries where rickets and malacosteon are prevalent, and where the baptismal belief of the people is opposed to craniotomy; but such an alternative must in time be made to defer to the judgment of wise and careful men.

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[1] Book v.

The most prevalent cause of dystocia which leads to the performance of the Cæsarean section is rachitic deformity of the pelvis, and next to it (in Europe) the pelvic collapse resulting from malacosteon. Other causes are the dwarfed or infantile pelvis; the kyphotic pelvis; the oblique pelvis of Naegele; the double ankylosed one of Robert; the coxalgic pelvis; obstructions by exostoses; uterine or pelvic fibroids; cancer of the cervix or vagina; occlusions resulting from inflammation and loss of tissue; and impactions of the fœtus in a transverse position; under which last form of dystocia 12 women have been operated upon in the United States with 8 recoveries. The measure of pelvic deformity requiring the operation is differently stated by obstetrical writers according to the ruling of their respective countries, and is placed at the lowest point in Great Britain, where the life of the fœtus is generally considered of little value if that of the mother is in danger. In our own country a much lower rate of death after elective and early operations has made operators less timid; and particularly is this the case now, after the lessened American mortality of the past two years, which promises to become much less still, in the future, particularly in hospital practice under which, up to December 1, 1886, all the operations, 9 in number, proved fatal. But since that date 7 women and 10 children have been saved out of 11 hospital cases, one of the 3 fatal ones being in the last stage of cancer.

RISK IN OPERATING.—This has been very materially diminished, both in Europe and America, in the last six years. In considering the amount of danger we must first estimate what legitimately belongs to the operation; and, second, that which is added to it by delay and futile attempts at delivery. The health of the patient prior to the commencement of labor has often much to do in determining a fatal result, as she may be the subject of some acute or incurable malady. If an operation is elective, the woman in good condition and of temperate habits, the past record of the United States shows that the mortality has been only about 25 per cent. against a death-rate of about 75 per cent. under similar conditions in Great Britain. This reversal of figures shows that the relative advantages of the English and American women are greatly in favor of the latter. The American patient is, on the average, better clothed and fed, more comfortably housed, and much less addicted to beer- or gin-drinking, than the English woman, and has only been 21 times operated on in hospital out of 175 cases. The English subject is, as a rule, much poorer and has far less stamina than the American woman; hence the fact that so small a proportion of the English recover after abdominal delivery.

Patients in country and village practice in France, Belgium, and Germany, and particularly where the same operator has had a series of cases, have in the past made a larger proportion of recoveries than in the larger towns and cities: this was also true of our own country until quite recently. Prior to a few years past the chief operators of Europe were Dr. Ludwig Winckel of Gummersbach, near Cologne, who operated by *true* Cæsarean section 13 times, saving 5 women and 10 children: Dr. J. P. Hoebeke of Sotteghem, East Flanders, who had 9 operations, saving 5 women and 9 children, one woman bearing twins; Dr. Dècouene of Courtrai, Belgium, who operated 6 times, saving 5 women and 4 children; and Profs. Stolz and Kilian of Bonn, who each operated 7 times and saved 4 women. Several operators have exceeded the number of cases in the hands of these men, in Naples, Milan, and Cologne, but the mortality was proportionately much greater. The general mortality in the United States has been 62 per cent., and in England about 80 per cent. We have surpassed England also in the number of cases operated upon, the American record counting 175 operations with 65 women saved, and the British 152 operations with 30 women saved: the full record of Great Britain has not been taken, as a diligent search for unpublished cases has not been made, as has been done in the United States. The work of the last two years in the respective countries shows a great proportionate increase in the number of operations in the United States over preceding years, and as compared with Great Britain, and a very encouraging diminution in the death-rate, due almost entirely to the introduction of aseptic management in the cases and the new method of closing the uterine wound.

CAUSES OF FATAL RESULTS.—Delay in operating, especially in this country, has had a great deal to do with the high rate of mortality in the past. Delay alone, as under a midwife who has simply waited for nature to accomplish the delivery and has not interfered, is not so potent a factor of evil as where the time has been largely consumed by futile attempts to deliver, under which the fœtus has perhaps died. There is a very decided connection between the fate of the child and mother, as will be seen by an examination of our Cæsarean record. More children than women are saved, it is true, but in a series of operations where scarcely a child has been found dead on delivery, it will be noticed that a large proportion of women have recovered, and *vice versâ*. The continuance of severe and oft-repeated labor-pains where there is no advance in the fœtus has a very depressing effect upon the woman, both as to her mind and strength, and a uterus kept long in action not only fails to contract well upon being emptied, but its tissues are injured by the muscular action and resistance, and do not heal readily after the incision is closed either by contraction of muscles or by sutures inserted. The exhaustion produced by labor favors the production of uterine hemorrhage from inertia, the consequent formation of a cardiac embolus, and death by collapse. As rachitic women are generally dwarfed and their physical strength is below the average, death from shock and exhaustion very frequently follows an operation executed after delay; and a labor of only a few hours in a dwarf may produce great prostration and result in death. A rachitic dwarf will bear an early operation and recover, but rarely does this when exhausted by too long waiting. Under the new method, which has been so successful in Germany and Austria, promptness has been an important factor in securing success. Death by hemorrhage directly has rarely resulted after the Cæsarean section, but death from heart-clot is no doubt more frequent than has been recorded. Peritonitis is a common cause of death. When the uterine wound is well closed by deep and superficial multiple suturing, so that blood and lochia cannot enter the abdominal cavity, the risk of this form of inflammation is greatly reduced. Septicæmia and septic peritonitis are much to be dreaded, but are more rarely fatal than before the new improvements were introduced. When the fœtus is dead and putrid there is a greater than usual risk of blood-poisoning from the absorption of septic matter, and such cases are safer after the removal of the uterus and its contents by the plan of Porro and Müller, the organ being turned out of the abdomen before evacuation. Some very remarkable escapes from death by septicæmia due to the removal of the atonic uterus and its putrid contents have been recorded in Europe.

MODES OF OPERATING.—Our attention must be confined to the plans under which the abdominal incision has by common consent been made in the linea alba. Few operations as grave in character have ever been performed successfully with as little assistance as some that occurred in the early days of this country. Before the use of anæsthetics and antiseptics the section was once made in Ohio under the light of a tallow candle and with the aid of two women, and the patient recovered:[1] she was a large woman and had never suffered with a bone disease. As delay is much more dangerous in country cases than it is to operate without antiseptic precautions and securing a full corps of assistants, the operator will be much more likely to succeed if he does not waste time in sending for distant aid. If he is confident that the operation is demanded, he can at once proceed with the aid of one physician and a few women. By the use of hot spring-water for cleansing and the aid of a woman to thread his needles he may make even an excellent substitute for the most improved technique of asepsis and the multiple uterine suturing. In cities, and especially in hospitals, success is rarely attained so readily. As the subjects and their hygienic surroundings are usually very inferior as compared to the women of the farm and village under their advantages of a free circulation of pure air, they (that is, of the city) must have every possible benefit that asepsis and a carefully-tested technique can give them; and here the city woman has the advantage that all needed aid and appliances are near at hand. The most important directions to be given both for country and city operations are—1. Let there be no unwise delay in operating or injudicious attempts to deliver *per vias naturales.* 2. Observe as great care as possible in making the person of the patient and the instruments to be used absolutely clean. 3. See that the abdominal cavity is thoroughly cleansed of blood and amniotic fluid after the uterus has been emptied, and again after it has been sutured. 4. Close the uterine incision so as to prevent the possibility of fluid escaping into the peritoneal cavity and setting up septic peritonitis; to do which effectually many deep and superficial uninterrupted stitches (ten or more of each) should be inserted, and the edges of the peritoneal coat of the uterus welted inward into the incision.

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[1] *Western Journ. of Med. and Phys. Sciences*, 1830, vol. iii. p. 485.

Modern Antiseptic Operation.—The patient is to have her bowels and bladder well emptied; she is to be warmly dressed, and after being etherized in bed is to be removed to the operating-table, the temperature of the room being at 75° or 80° Fahr. The room may be prepared previously by spraying with dilute carbolic acid, if thought desirable, but the use of spray during the operation has been very generally abandoned, as in ovariotomy, because of its poisonous effects on operator and patient. After placing the woman as for ovariotomy, her abdomen is to be washed with warm water and soap, then with ether, and finally with a 5 per cent. solution of carbolic acid or 1 : 1000 corrosive-sublimate water. The vagina is to be washed out with a 2 per cent. solution of the former or 1 : 2000 of the latter. The operator stands to the right of the woman, and his chief assistant opposite to him. Four assistants constitute a full corps when they are available—one to give ether; one to attend to the sponges and thread needles (this may be a nurse); a third to hand instruments; and a fourth to manage the abdominal parietes, keep back the intestines, compress the abdomen against the uterus, use manual compression if required, apply compressing forceps, etc. The resuscitation of the fœtus, if requisite, is generally committed to some visiting physician present. The incision is to be made in the linea alba from the umbilicus to one and a half inches from the symphysis pubis, and may be carried through and beyond the navel in cases of dwarfs. Spring forceps are to be used to compress any bleeding vessels in the abdominal wall, and the uterus is then to be incised longitudinally with a scalpel to the extent of about five or five and a half inches, care being taken to avoid the fundus and cervix because of their greater vascularity; or the wound may be made partially and extended by a probe-pointed bistoury. The first assistant may now hook up the uterus by inserting an index finger at each end of the incision, as recommended by Dr. Ludwig Winckel, or he may use manual compression of the cervix to check hemorrhage. If the waters have not been evacuated, the membranes are to be torn and the patient turned upon her side, or the waters can be evacuated *per vaginam.* In hospital service the use of the caoutchouc dam and apron placed under the patient will be of great value in conducting all fluids lost or used in washing into a waste-bucket, as employed by Dr. H. A. Kelly of Philadelphia. If the fœtal head presents at the wound, the operator should deliver it first; but if not, he should seize the feet, turn, and deliver. By many, the operation under long abdominal incision is preferred, in which case the uterus is turned out entire, the cervix is constricted by the elastic tube of Esmarch, and the organ is then incised and evacuated, the abdomen having been previously protected by cloths or a caoutchouc diaphragm to prevent the fluid contents from entering the abdomen. If asphyxiated—which is generally the case where the Esmarch constriction is used—the fœtus should be carefully attended to until it breathes satisfactorily. The woman should receive a hypodermic injection of ergotine, and when the placenta separates the operator should remove it, cleanse out the clots, and mop out the uterine cavity with carbolized sponges. If there is hemorrhage, he should swab the uterus with vinegar, tincture of iodine, or alcohol, and in very extreme cases with a solution of persulphate or perchloride of iron. In a case under Dr. Fasola of Florence, Italy, the bleeding was so uncontrollable that he was forced to complete the operation after the method of Porro, in order to save the woman from death by hemorrhage: the patient recovered. This must have been a very exceptional case, as I know of no other like it. If the placenta is under the line of incision, it should be separated on one side, or it may be necessary to tear through it to effect a hurried delivery. Compressing forceps may be required temporarily to check the bleeding from the edges of the uterine wound, and ligatures have in some instances been used. This tendency to hemorrhage is very variable. I have seen a placenta under the line of incision separated entire before delivery with very little bleeding, and I have seen a very active hemorrhage from a vein in the edge of the uterine incision where the placenta was attached posteriorly. If the cervix uteri has not been dilated before the operation, a utero-vaginal drainage-tube should be inserted. The uterine wound is next to be closed with deep-seated and superficial sutures of carbolized silk. The deep sutures should pass down nearly to the uterine lining, and the superficial ones should be inserted between them, so as to turn in the peritoneum and bring its serous surfaces in apposition, as this plan secures the most rapid union. Many stitches are much better than a few, because the individual tension is correspondingly less and the wound is much more tightly secured against leakage. The interrupted suture, making a directly opposite antagonism instead of an oblique one, is better adapted to closing a shortening wound than an uninterrupted one, which by this change of length has a tendency to slacken. The next step is to cleanse the abdominal cavity by pouring in warm distilled water, which when removed by stem-sponges may be succeeded by still further mopping out with carbolized sponges. The abdomen, after being closed by silver-wire or silk sutures, is to be carefully washed and dried, and then dressed antiseptically, as after an ovariotomy.

Prior to operating, the instruments, sponges, and cloths to be used are to be placed in a 2 per cent. carbolic-acid solution; the hands of the operator and his assistants are to be scrubbed with a nail-brush and with warm water and soap, after which they are also to be treated with the carbolic solution; and the hands soiled in the operation are from time to time to be re-washed.

Uterine Sutures.—The greatest improvement ever made in laparo-hysterotomy was the introduction of the uterine suture; and it is a marvel to us now that the world of surgery was so long in discovering its value. Timidly initiated one hundred and nineteen years ago, it was nearly a hundred years before it came to be regarded as of any special use in saving life, and even then there were few to advocate it, and they were chiefly in our own country. Why an internal wound which was liable to relax, elongate, and gape open was allowed for more than two hundred and fifty years to depend for its closure upon the contraction of the uterus and its continuance is a complete mystery. Hypotheses as to the dangerous consequences of uterine suturing no doubt ruled it out of the field of experiment, and the opposition excited by its first trial was potent enough to keep it out of Europe during an interval of sixty-seven years more. The first operation upon record in which uterine sutures were used was performed by M. Le Bas, a surgeon of Mouilleron, France, on August 27, 1769, the case being one of impaction with an arm protruding, the fœtus dead, and the woman three days in labor.[1]

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[1] *Journ. de Med., Chirurg., Pharmacie, etc.*, tome xxxiv. p. 177, 1770.

As the report was made in a letter by Dr. Gallot, we are simply informed that the uterine wound was closed by "two or three points of suture" and the abdomen by four. This was M. Le Bas' second operation, and both ended successfully. A very extensive search for cases has failed to find a second between 1769 and 1828, when a Fairfax county charlatan of Virginia, who had quite a reputation as a bold surgical operator, repeated the experiment upon a mulatto multipara of twenty-five in a case of obstruction of fifteen months' standing due to occlusion of the cervix and a calcareous incrustation over the internal os uteri. Two or three sutures of silk were used in the uterine wound, and the case progressed favorably until the middle of the second week, when, by partaking largely of animal food and cider, she brought on an attack of peritonitis that proved fatal in forty-eight hours.[1] The third operator was Dr. Wiefel of Hullesenbush, whose case was reported without the year in February, 1838, and must have been operated upon on August 22, 1837, or earlier: he used only one suture; the patient recovered.[2] The fourth operation was that of Godefroy de Mayenne, who operated on Madame Patrice of Oisseau, near Mayenne, on March 27, 1840. This woman was rachitic, 4 feet 3 inches high, a primipara of forty-two, and with a conjugate of 2 inches. Three sutures of waxed silk were used to close the uterine wound, and the woman and child were saved.[3] The second case in the United States was that of Dr. Gamaliel W. Holmes of Early county, Georgia, in 1851; sutures of silk, woman lost.[4] The third was that of Dr. Frank E. Polin of Springfield, Kentucky, who operated upon Mrs. Mary Brown on November 25, 1852, the cause of dystocia being a hydrocephalic and strongly ossified head. The original statement was that silver wire was used to close the uterine wound, but more recently his brother has claimed that he employed catgut. I am inclined to credit the first, which was said in 1880 to have been taken from his own notes.[5] Mrs. Brown bore two children at later periods, and was living thirty years after the operation. In 1867 there were two more cases in the United States—one under Dr. T. Beers Townsend of New Haven on November 15th, and the other under Drs. D'Aquin and Brickell of New Orleans on December 21st. The first subject was black, sixteen, conjugate one and a half inches, in labor sixty-two hours and a half; three uterine sutures of fine hemp were used; woman recovered. The second subject was a French creole, twenty-three, with occlusion of vagina and os uteri; in labor ten days. Uterus flaccid after delivery; wound closed with six silver-wire sutures. Woman alive and well in November, 1877; was not again pregnant: no inconvenience experienced from presence of wires. The system of uterine suturing has been very gradually introduced into the United States, until now scarcely a case is reported in which it has not been used. When we read of the success that attended the early cases we are astonished that the plan of suturing was not long ago adopted. Prof. Brickell of New Orleans advocated the introduction of uterine suturing in his lectures as early as 1856, and eleven years later tested it with satisfaction in the case already mentioned.

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[1] *Amer. Journ. Med. Sciences*, O. S., vol. xviii. p. 257, 1836.

[2] *Casper's Wochenschrift*, S. 123, 1838.

[3] *Gaz. méd. de Paris*, No. 28, 1840.

[4] Private record.

[5] *Medical Herald*, vol. ii. p. 352.

The closing of wounds of the abdomen by deep-seated and superficial sutures was taught eighteen hundred years ago, in the time of Celsus, but the application of this method to the wound of the uterus was not made until quite recently. I have failed to find any case in which more than one line of sutures is reported to have been taken before September 18, 1874, when Dr. R. O. Engraham of Montezuma, Macon county, Georgia, is said to have inserted three deep sutures, three half-deep, and four in the peritoneum, of carbolized silk. The woman recovered, and was living several years later, but her case was not reported until after a lapse of eleven years, when the improved operation of Germany had been performed twenty-three times, and not until after he operated a second time, in the same way, but with a fatal result, in 1882.[1]

Multiple suturing in two rows was first tested in May, 1882, at the suggestion of Dr. Sänger of Leipzig, by Dr. Leopold of Dresden, the number used being twenty. Prior to this time but few sutures, all deep-seated, except perhaps in one instance, were inserted, varying in number from one to ten.

NEW METHODS OF PERFORMING LAPARO-HYSTEROTOMY.—Germany has in the past ten years furnished the Cohnstein, Frank, Kehrer, and Sänger processes, only one of which has well stood the test of experience—*i. e.* the last. The first three may be found fully explained in the *International Encyclopædia of Surgery*, vol. vi. pp. 655–658.

The Sänger Process, also known as the New or Improved Cæsarean Operation.—To Dr. Max Sänger of Leipzig are due three important changes in the manner of closing the uterine wound—viz.: 1. The use of a largely increased number of interrupted sutures. 2. The arrangement of the sutures into two rows, deep-seated and superficial. 3. The application of the sero-serous intestinal suture of Lembert to the uterine wound, so as to welt in the peritoneum and secure an early union by maintaining the serous surfaces in contact. In his original scheme it was proposed to resect a portion of the muscular edges of the uterine wound, and to dissect a narrow portion of the peritoneal coat from the muscular, so as to favor a ready turning in of the former; but after a few trials it was discovered that the peritoneum could be made to slide over the muscular coat without dissecting up the former or resecting the latter, except in a few cases where tissue-changes prevent the sliding process from being carried out; and this requirement of the original scheme was abandoned. The principle upon which the resection and "undermining" were founded remains in full force, as these were simply means for the accomplishing of an end which can be attained without them. To say that these were the main changes introduced by Dr. Sänger, and that their abandonment left him without any title to credit, is an error, for the three points of improvement remain intact. In August, 1880, Dr. Sänger performed his first Cæsarean operation, closing accurately the uterine wound with the peritoneum edge to edge, and the woman recovered. This was not what has since been called by his name, as not one of the three features mentioned were then tested. This case, however, led him to investigate the historical features of the Cæsarean operation, and to prepare a monograph of two hundred pages in which he presented for consideration and trial the improvements already named. The paper was completed in December, 1881, and appeared early in 1882.

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[1] *Atlanta Med. and Surg. Journ.*, vol. xxvi. p. 469, 1885–86.

The plan of operation is as follows: The abdomen is washed and the vagina disinfected as directed for the "modern antiseptic operation," after which the incision is made to correspond with the plan to be carried out. If it is proposed to turn out the uterus before opening it, the incision is to be made of suitable length. When this is done the upper part of the wound is to be prepared by the insertion of two or more long, slack sutures, to be drawn upon after the uterus is turned out. The next step is to bring out the uterus by the fundus; then to draw the long sutures upward toward the ensiform cartilage, so as to close the wound beneath the uterus; then to protect the abdominal cavity by surrounding the cervix with a sheet of caoutchouc moistened with a 5 per cent. solution of carbolic acid; then to constrict the cervix with Esmarch's elastic tube; and, lastly, to evacuate the uterus by incising its anterior wall vertically at its middle third, so as to avoid the fundus and cervix. The fœtus will be found asphyxiated because of the temporary arrest of its blood-supply, and must be given to an assistant selected to resuscitate it. When the uterus is well contracted the tube may be removed, and any bleeding from the wound may be stopped by forceps. The wound in the uterus is now to be closed by a number of deep-seated sutures made to pass through the peritoneal and muscular coats, but to avoid the mucous coat. These may be made of virgin-silver wire or carbolized silk; catgut is very unreliable, as it either stretches or the knots become untied. After these are tied and the peritoneum is turned in by sliding and the use of the handle of a scalpel, this coat may be still more drawn upon by alternate superficial sutures of carbolized silk introduced after the manner of Lembert, which when tightened will fix the serous surfaces in contact and secure an early union. Before any of the uterine sutures are tied the uterine cavity is to be washed out with an antiseptic fluid, and if the cervix has not been well dilated, drainage should be secured by the insertion of a utero-vaginal tube: abdominal drainage is not required, as there is no leakage where the closure is properly made. The number of sutures employed in different operations has varied from twenty to thirty-five.

Where the operation by short abdominal incision is preferred, the cervix may be constricted by manual compression to avoid hemorrhage until the uterus has contracted, when the organ may be washed out, then sutured, and the abdominal cavity cleaned by irrigation with warm distilled water. Sir Spencer Wells has taught that long abdominal incisions in ovariotomy added to the risk of the operation. This is plausible but fallacious, and is not borne out by the experience in Porro operations after the Müller plan. In ovariotomies the simple cases require but a small incision, and where a long one is made it is because it is rendered necessary by reason of adhesions to be overcome or of complications adding to the risks of the case; hence the real danger under a long incision does not lie in the incision itself. This is also shown to be true by the results of the Sänger Cæsarean cases.

In exceptional cases the peritoneal coat has been found so tightly adherent to the muscular that resection and separation of the muscularis and peritoneum have been found requisite; and in one American case because of the existence of a mural fibroid three-quarters of an inch of the muscularis was exsected, with the recovery of the patient. Small mural fibroids when cut through and closed up in the wound have suppurated and caused death by septic poisoning. In one fatal case three such tumors had been cut through.

The improved Cæsarean method of Sänger has worked a revolution in opinion as to the dangers of laparo-hysterotomic delivery, and craniotomy is being placed more and more upon the defensive. By prompt action, the use of antiseptics, and delivery by the improved abdominal method, Germany has largely reduced the mortality of the Cæsarean cases in her maternities; and other countries have profited more or less according to the closeness of their imitation and faithfulness in carrying out the instructions she has given.

Results Attained by the Improved Cæsarean Operation.—The operation, as far as reported, has been performed 149 times by 82 men in Germany, America, Austria, Italy, Russia, Switzerland, Holland, France, Belgium, India, and Denmark, saving 108 women and 136 children (the fate of 3 children not having been given). Germany, having exercised the greatest degree of care and having adhered the most rigidly to the technique, has saved the highest percentage of cases: 80 operations have been performed in 18 cities and towns by 38 operators, with only 12 deaths. Prof. Leopold of Dresden has operated 17 times with 3 deaths—a success which is a fraction below the general result under the whole of the German operators. The Austrians have had 17 operations and saved 12 women and 15 children. In our own country there have been 22, but with a loss of 13 women and only 3 children. In the past two years there has been a remarkable change for the better in the United States, and now cases in hospital are much more rarely fatal than in former years, and even less dangerous to operate upon than in private houses.

The improved Cæsarean operation cannot be made to work miracles, and it should be understood that it largely depends for success upon the prior condition of the woman. Cases do recover under adverse circumstances that would be fatal under the old method, where antiseptics and uterine closure were not used; but a very early operation on a healthy woman, especially in America, performed according to the old method, gave a greater average promise of success than the new one now offers in women exhausted by long labor where futile attempts have been made to deliver *per vias naturales*. Although a patient may recover after a long labor where the improved operation has been used, she is not likely to make a rapid convalescence. Exhaustion of system favors attacks of peritonitis and crural phlebitis. Sepsis has much to do with these sequelæ, but there are cases of which sepsis is innocent as a factor. Long-continued action of the uterine muscles produces a condition which, like a contusion of parts, is antagonistic to union by the first intention: the peritoneum will heal under multiple suturing and prevent leakage, but the muscularis will gape; and if it does not favor septic absorption in a given case, the union may be slow and tedious: both the uterine and abdominal wounds may reopen, and unite secondarily by granulation, as sometimes happens. To secure a satisfactory result, not only as to the life of a patient, but as to rapidity of recovery without drawbacks, the new operation requires to be done early, and that the subject should not be anæmic, coxalgic, phthisical, intemperate, or otherwise unhealthy. As Cæsarean subjects are generally of the poorer class, they can be better cared for in hospital than at home, and should be seen, if possible, by the operator prior to the commencement of labor. The possibility of delivering a living fœtus in a case of pelvic obstruction ought to be determined by the touch and pelvimeter, and never by experimental trials of the forceps and by attempts at version, because success in the Cæsarean operation depends very much upon the physical strength of the patient at the time it is commenced. If one hundred rachitic women in the last days of gestation should enter a hospital for delivery, and should be operated upon by the method of Sänger early in labor, I should expect to find that 80 per cent. of the women had recovered, or perhaps as high as 90 per ment. A promising case is often rendered unfavorable, if not actually hopeless, by attempts to prevent a resort to the Cæsarean operation, the fear of which has often led to its being made a final and fatal mode of delivery when it should have been the contrary.

An examination into the causes of death after the improved Cæsarean operation will develop the fact that few cases die as a direct result of the surgical delivery. A few are hopeless from pre-existing disease, or may be actually moribund, as from cancer, cardiac lesions, or granular degeneration of the kidneys. Some die of shock and exhaustion as a natural sequence of a long labor in which futile attempts to deliver were made by the forceps, version, or craniotomy, singly or all three. Some have died of post-partum conditions, entirely independent of the effect of the knife, as from diphtheritic endometritis or other disease endemic in hospital. Even peritonitis has been found on autopsy to be entirely independent of the operation or the parturient state; as, for example, where it was produced by a perforating ulcer of the intestines, cicatrices of pre-existing ulcers being found, as in the third case of Prof. Chiara of Florence, Italy, operated upon on January 5, 1888. Death from septicæmia or septic peritonitis may occur in a promising case, but such deaths are rare under the aseptic treatment. Saline purgation and abdominal irrigation have saved cases of peritonitis where the symptoms were of a very grave character. Death by secondary hemorrhage, so common at one period, is now of exceedingly rare occurrence; it was never a common result of the operation in America.

The Porro-Cæsarean Section. Laparo-hystero-Oöphorectomy.

It is an absolute essential of the Porro supravaginal amputation of the uterus that laparo-hysterotomy with delivery of a fœtus shall have preceded it; hence the impropriety of giving the name of the Pavian professor to a supravaginal amputation following a rupture of the organ, as he styles his modification a "utero-ovarian amputation as completive of the Cæsarean operation." Now, what is a Cæsarean operation? The abdomen must be incised and a pregnant uterus must be cut open for the delivery of a fœtus, or the section is not Cæsarean. To open the abdomen and remove a fœtus from the peritoneal cavity or from an extra-uterine cyst is not a Cæsarean operation, although often erroneously called so; the fœtus must be in the uterine cavity, and the operator must remove it by abdominal and uterine incisions. This is a very old and unalterable definition of the term "Cæsar cut;" and the reason for it is based on the fact that classification and the records of mortality demand that the three forms of cases should not be statistically confounded. The Cæsarean and Porro-Cæsarean operations are intended to save two lives; laparotomy after ruptured uterus is almost universally performed after the fœtus is dead, and laparo-cystectomy in extra-uterine pregnancy has until quite recently had a very high mortality for both child and mother.

HISTORY.—The idea of removing the uterus after performing the Cæsarean operation seems to have successively entered the minds of quite a number of obstetricians and vivisectors during a period of more than a hundred years. Prompted by a desire of the celebrated Antonio Cocchi, Dr. Giuseppe Cavallini, surgeon-in-chief of the Santa Maria Nuova Hospital of Florence, was led to try a series of experiments upon dogs and sheep to determine the danger of extirpating the uterus, with a view of trying it as a means of curing cancer of that organ. Dr. Cavallini extended the experiments in the direction of obstetrics, and successfully exsected the womb of a bitch that contained nine pups; after which he wrote: "I do not doubt that the uterus is not at all necessary to life; but whether it may be plucked out with impunity from the human body we cannot be certain without a further series of experiments of this kind, *which perhaps a more fortunate generation may obtain.*" Dr. Cavallini published an account of his experiments in a monograph in 1768 entitled *Tentamina medico-chirurgica de felici in quibusdam animantibus uteri extractione.* The idea of Cavallini contemplated a complete removal of the uterus, and not an amputation at its neck. It is a singular coincidence that a Mrs. Cavallini should have been the first subject of uterine removal under the Cæsarean scheme of Prof. Porro one hundred and eight years later.

The next to consider the same subject was Dr. G. P. Michaelis of Marburg, who wrote in 1809: "It is indeed a question whether the Cæsarean section would not be less dangerous if with it were combined the extirpation of the uterus." Here, again, we have the idea of complete hysterectomy.

Dr. James Blundell of London, whose obstetrical observations and opinions placed him far in advance of his time, and make his writings of much value even now, was led by a series of experiments to express the same opinion, which was thought to be very wild and visionary by his colleagues. After saving three rabbits out of four under hysterectomy, he wrote in 1828 as follows: "In speculative moments I have sometimes felt inclined to persuade myself that the dangers of the Cæsarean operation might be considerably diminished by the total removal of the uterus." . . . . "Perhaps the method of operating may hereafter prove an eminent and valuable improvement." Here we have, for the third time, the idea of removing the entire uterus.

Dr. Jéser in 1862 removed the gravid uteri of four bitches, and saved two of them, as reported by Dr. Fogliata.

Dr. Giacinto Fogliata of the Veterinary School of the Royal University of Pisa instituted a series of experiments in 1874, and saved three non-gravid bitches out of four after the removal of their uteri.

Prof. Edoardo Porro, then of Pavia and now of Milan, like Prof. T. Gaillard Thomas of laparo-elytrotomic fame, was in entire ignorance of the work of his predecessors, and instituted a set of experiments like those of Fogliata, also in 1874, by removing the gravid uteri of three rabbits, all of which recovered. He had performed a Cæsarean operation in Milan in July, 1871, upon a young rachitic primipara, who had been in labor twelve hours, but lost the patient in fifty hours from internal hemorrhage and metro-peritonitis: the child was saved. As the old Cæsarean method had been universally fatal in Pavia, and a mere fraction out of a large number of cases had escaped in Milan, Prof. Porro made his experiments in the hope of finding a less fatal scheme of delivery, and was happily successful.

He was not the first operator who performed supravaginal amputation of the uterus after a laparo-hysterotomy, but was the first to do so as the result of a predetermined plan of operating. In 1869, Prof. Horatio R. Storer of Boston (now long a resident of Newport, R. I.) performed the Cæsarean operation in a case of obstruction from a fibro-cystic tumor, and was *forced* to remove the uterus to prevent the woman from bleeding to death, as was done of necessity in 1886 in the experience of Dr. Fasola of Florence, already mentioned. Prof. Porro operated upon Mrs. Giulia Cavallini (strange coincidence in the name!) on May 21, 1876, one hundred and eight years after Dr. Giuseppe Cavallini had written in so predictive a way about the future of hysterectomy. Signora Cavallini was a rachitic primipara of twenty-five, 4 feet 10½ inches in height, and having a true conjugate of $1\frac{9}{16}$ inches. She had been in a private room of the hospital and under a tonic regimen for twenty-four days prior to the operation, which differed in one important feature from the propositions of Cavallini, Michaelis, Blundell, Jéser, and Fogliata in that amputation of the uterus at the cervix, and not the entire extirpation of the organ, was in contemplation.

Mode of Operating.—According to the directions of Prof. Porro, the first steps in his method are the same as for the modern antiseptic Cæsarean section, with the uterus *in situ*, up to the point where suturing of the uterine wound is to commence. Here the whole plan changes, and supravaginal hysterectomy, including the tubes and ovaries, begins by first turning out the organ through the abdominal wound, and then holding it vertically until the wire loop of the constrictor of Cintrat is passed around the cervix at a point opposite the internal os uteri and tightened by turning the screw; after which the cervix is to be cut through about two centimeters (¾ inch) above the wire and the mass removed. The abdominal cavity is next to be cleansed with carbolized sponges, and a five-millimeter drainage-tube is to be passed through the abdominal wound, the Douglas pouch, and out by the vagina. The abdomen is now to be closed with silver-wire sutures, the stump touched with perchloride of iron and fixed in the lower angle of the wound, and the parts dressed with simple applications.

The first subject of the operation recovered in forty days, and lived several years: the child was saved.

Numerous changes have been made in the operation since its initial trial, some of them being for convenience, while others have been of vital moment, and a few very fatal. Transfixing pins were adopted to prevent the stump from falling in after the constricted part should drop off—an accident that happened early in the history of the operation. Changes were made in the form of constrictor, some preferring that of Kœberlé or Maisonneuve or the ovariotomy clamp of Spencer Wells; others cut through the cervix with the écraseur of Chassaignac or Billroth. The drainage-tube was abandoned or used only in the abdomen. Operations were performed under spray and Listerian treatment used: they were also made bloodless in large measure by the application of Esmarch's tubing around the cervix. To avoid the placenta the uterus was incised transversely above the internal os and opened to the required size by laceration. Of all the changes, two deserve special consideration—viz. the modification introduced by Müller of Bern, Switzerland (Case 9 in chronological order), and by Veit of Bonn, Germany (Case 50).

Müller's Modification.—This was introduced by Prof. Müller at his first operation, on February 4, 1878, as an improvement upon the eight operations that preceded it, and as especially adapted to cases like his own where the fœtus is dead and putrid and there is danger of septic matter escaping into the abdominal cavity upon delivering it. The subject of his operation was a malacosteon multipara of thirty-seven, who had been three days and a half in labor and had a pulse of 136. After making a long incision the uterus was drawn out and then incised, the abdomen having been previously protected against the admission of fluid and the cervix constricted. By the removal of the uterus and its septic contents the woman's pulse was reduced after the operation to 96, and by the next day to 84, while the temperature fell from 102° to 97° Fahr. This patient, however, made a narrow escape, as her pulse on the eleventh and twelfth days reached 140 and 150 respectively, and there was a gangrenous appearance about the abdominal wound. The result of the case led to the belief that the modification was of value over the original plan in some cases, and to its adoption by many as a substitute. The plan of opening the uterus outside of the abdomen was next adopted by Prof. Chiara of Milan in Case 13. Labor was induced in the case of a rachitic dwarf, 4 feet 3½ inches in height and twenty-three years old, and after it had progressed twelve hours the section was made. The operation saved the child, but the mother was lost through septic peritonitis on the fourth day. This put an end to the plan in the Maternity of Milan, but in many other hands it was quite a successful method, and eventually became part of the Sänger scheme of operating. As the constriction of the cervix produces asphyxia in the fœtus, the operation should be rapidly completed after the wire is drawn, and the child taken in hand for resuscitation. The Müller plan of operating has saved about half of the cases subjected to it. The uterus cannot always be turned out after the long incision is made, and in this event the operation must be completed with the uterus *in situ.*

Veit's Modification.—Not satisfied with certain features in the Porro and Müller methods, in each of which the cervical stump is dressed externally, and for reasons of safety contemplated in the original design of the former, Prof. Gustav Veit of Bonn, Germany, adopted the plan of treating the stump as a pedicle by ligating and dropping it into the pelvic cavity, and tried his first experiment with it on March 21, 1880, which resulted in the death of the patient from septic peritonitis in seven days. Three other operators, all within a period of five weeks and in chronological order—one of them experimenting upon two subjects—repeated the same method, with a fatal result to each woman. Six months after his first trial, and after five women in all had been lost, Prof. Veit made a second attempt, and was then successful. Cases 7, 8, 9, 10, and 11 under the same intraperitoneal method were all fatal. Case 12, under Dr. Kabierski, Jr., of Breslau, Case 13, under Dr. August Martin of Berlin, and Case 14, under Prof. Fritsch of Breslau, ended in recovery. But for the increased measure of danger the intraperitoneal method of treating the stump in supravaginal hysterectomies would be for many reasons preferable to the extraperitoneal, and on this account various methods of treating the amputated portion have been tried by different operators in the hope of diminishing the risk of hemorrhage from shrinkage and of septic poisoning from the dropped-in stump. The amputated end has been ligated with silk in several ways, and with silver wire; it has been cobbler-stitched; and the peritoneum has been sewed over the end by numerous stitches. It has also been proposed to turn the stump into the vagina to avoid the danger of its presence within the peritoneal cavity. Supravaginal amputation of the uterus is much less under control in a Cæsarean than in a non-pregnant case, for the reason that in the former the cervix is greatly larger, and shrinkage may take place in a few days from the size of the wrist to that of a finger, as shown by the record of the Prevôt case of Moscow, Russia, where the hemorrhage repeatedly recurred from the constricted stump, which was secured externally by a serre-nœud, and was the cause of the woman's death. The causes of death under the Veit modification have been shown by autopsy to have been mainly septic or hemorrhagic, as might be theoretically presumed. The dragging of the cervix and vagina upon the abdominal cicatrix is at first a serious objection to the extraperitoneal operation, and this attachment is in the way of the expansion of the bladder; but in time the tension is overcome and the remnant of the stump becomes an elongated cord. The much greater safety of the original Porro plan of treating the stump should make it decidedly preferable to that of Veit.

Other Minor Changes.—We are all familiar now with the application of the method of Esmarch to the control of hemorrhage in the Cæsarean operation, and especially as employed in Germany under the improved method. As Prof. Carl C. Th. Litzmann and Prof. Esmarch both lived in Kiel ten years ago, it was very natural as well as wise in the former to make trial of the elastic tube of the latter in a Porro operation which he had occasion to perform on June 14, 1878, and, although the case terminated fatally, the result by no means invalidated the plan, for the patient had been three days in labor and was in a feverish, exhausted state; besides which the external os uteri was occluded, which afforded a lodgment for pus in the cervical canal, giving rise to septic infection, and to death on the sixth day. The compression of the cervix controlled the hemorrhage while the uterus was contracting, and thus was established the value of the apparatus in laparo-hysterotomy.

Manual compression, also now employed by some operators in preference to the Esmarch elastic tube, was introduced by Dr. Leon Oppenheimer of Wurzburg, Germany, on July 4, 1880, in a Porro operation that proved successful: he also made use of Sir T. Spencer Wells' ovariotomy clamp.

EFFECTS UPON MALACOSTEON SUBJECTS.—Although the Porro operation is much less frequently performed than it was five years ago, and has most largely fallen off in the maternities where it was once often performed, it is still of value in certain parturient conditions, such as where the uterus contains a dead and putrid fœtus, or where the woman is affected by a progressive malacosteon. Several years ago I took occasion to investigate by correspondence the effects of removing the uterus, ovaries, and tubes upon the health of malacosteon subjects who had recovered from the Porro operation, and found, as I had partly anticipated, that in some instances the bone disease had been checked, and in others entirely cured, so that after having been partly bedridden they had been restored to active life, one woman taking care of the rooms in a students' lodging-house. Dr. Fehling of Stuttgart was struck with the results in three of his own recovered cases, all having been cured of the bone malady, and one who was not far advanced in the disease walking "perfectly well." From these results Dr. Fehling conceived the idea several years ago of testing the value of oöphorectomy upon non-pregnant malacosteon women as a means of cure. He has, I am informed, investigated the conditions of a number of malacosteon women who have been benefited or cured by the Porro mutilation, and has begun to put into practice the plan of which he wrote to me. It is probable that the removal of the uterine appendages may cure some cases of malacosteon; but as the disease sometimes attacks in a severe form women who have never been pregnant, and even men, it is not likely that the cure can be general. Dr. Fehling found that to get the full benefit of the Porro exsection the malacosteon woman should not be permitted to nurse her child. As malacosteon proves fatal in the end, and is quite prevalent in some sections of Europe, it is important to test the effect of the only remedy that promises to cure the disease.

RESULTS OF THE PORRO-CÆSAREAN OPERATION.—There have now been more than 232 operations performed, and the method has been tested in almost all the countries in Europe, in our own country, in India, and in Australia. In a few maternities, like those of Milan and Vienna, and under a few special operators of unusual skill, as Profs. Breisky and Chiara and Dr. Fehling, the rate of mortality has been much below the general average; but take the whole of the record, and even exclude the cases in which the stump was dropped in, and the recoveries fall far behind the average of the Sänger operation in Germany. The general average mortality of all the cases is about 50 per cent., or about double that of the Sänger cases; but exclude certain moribund and Veit-managed cases, and we lower the percentage of death to 46. Under the Müller modification about one-half of the operations were successful. Germany lost 10 women out of her first 28 Porro operations, and 12 out of her first 80 Sänger operations. Austria saved 25 women under her first 38 Porro operations, or 65 per cent., but has not done so well as Germany in the Sänger method, but somewhat better than her own Porro record, having saved 12 out of her first 17, or 70 per cent. Italy out of her first 65 cases saved 28 women, against the first 65 Sänger operations of Germany with 54 women saved. We may fairly compute the mortality of the Porro operation as double that of the Sänger on the general average, with a prospect of the former having a lower rate in the future. The Porro operations of 1885–87 show a diminishing fatality.

PUERPERAL LAPARO-CYSTECTOMY.

More closely allied to the Cæsarean operation than any other is the new exsective method of saving both mother and child in cases of advanced extra-uterine gestation. To accomplish the abdominal delivery of a living and viable extra-uterine fœtus, so as to save it alive without the death of the mother, has long been the desire of the obstetric surgeon, but how to do it appeared to be a question of impossible solution until Dr. August Martin of Berlin on July 9, 1881, performed the first exsective operation, and demonstrated the possibility of removing by ligation and excision the whole abnormal growth, so as to escape the dangers of hemorrhage and septicæmia under placental exfoliation by not leaving any cyst or placenta to come away. Dr. Martin's operation was not as perfect in all points as some that have since been performed by other men who had cases of perhaps less difficulty; and in consequence of what he had to contend with and of the plan he adopted, the abdominal wound was many weeks in closing. But Dr. Martin was the pioneer in directing the way, and now the operation has been brought to great perfection, so that not only is life saved, but a more rapid convalescence is secured. Up to the time of Dr. Martin's operation there had been but 1 woman saved out of 20 operated upon by the former method of cystotomy, in which both cyst and placenta were either left intact or death was hastened by peeling off the latter from its attachments. With the exsective operation commenced a new era, and 5 out of 11 women have recovered. Of these cases, 7 were cystotomies, with 6 deaths, and 4 were cystectomies, without a death. These four were operated upon by Dr. Martin, Prof. J. Lazarewitch of Kharkof, Russia (now of St. Petersburg), Prof. August Breisky of Vienna, and Prof. Joseph Eastman of Indianapolis. Had the other six operators completely exsected the cyst and placenta, as was done by the two last, there would doubtless have been a much lower rate of mortality. The results of the four operations have been less fortunate as regards the children. The fœtus in Dr. Martin's case had an encephalocele, and did not respire on delivery, although the cord pulsated. In Prof. Lazarewitch's case the fœtus lived twenty-six days, had two attacks of convulsions, and died of inanition; the fœtus removed by Prof. Breisky lived nineteen days and died of an abscess near the umbilicus; and that of Prof. Eastman was alive and well when photographed at seventy-three days. The operation was performed on July 10, 1888, at eight months of gestation, and the patient made an excellent recovery. There will be great if not insurmountable difficulties to be met with in some of the forms of ectopic gestation; but the fact that all of the exsective operations have been thus far successful should be sufficient to encourage an obstetric surgeon to make trial of the same radical mode of operating. Already has this exsective plan of operating borne valuable fruit in Berlin and Copenhagen in its application to cases before the viable period, when the difficulties of the removal of the cyst and placenta, particularly at four or five months, will generally be found somewhat less than at eight or nine months.

In performing the operation care should be taken to open the cyst so as not to injure the placenta, which is often found at the top of the sac. When the fœtus has been removed and the cyst is empty, the abdomen should be very carefully cleansed, so as to expose to view the attachments of the cyst to the intestines, omentum, and other contiguous parts. These should be tied and separated until the cyst is free above, when the tedious exsection of it and the placenta will commence. In Prof. Eastman's case, which he claims to have been a true Fallopian gestation, he was enabled to control the hemorrhage by clamping, under which mode of compression he was able to form a pedicle, which he cut off and then quilted in with a cobbler's stitch of iron-dyed silk, after which the clamp was removed and the abdomen irrigated with hot water.[1] There was very little shock under this operation, which was rapidly recovered from, the patient having her bowels moved on the third day and the drainage-tube removed on the fifth.

This new operation is made one of additional interest because of the fact that death has resulted in quite a number of instances from extra-uterine pregnancy in women of the higher walks of life. Unlike the Cæsarean operation, which is largely necessitated by poverty, it may be required by women in any social position, although it has rarely happened that the fœtus has developed to a viable age, because rupture and death have usually occurred. But still, there are those in this city who can recall to memory cases lost after the fœtus was viable that might at this day, in all probability, be saved like the Eastman case. I can recall to my recollection the cases of the wife of a banker, of a merchant, and of a physician who were all the subjects of ectopic gestation, and no doubt Drs. Thomas and Barker of New York could add several of the same positions to the record. It will not be advisable hereafter to await the death of the fœtus, and thus endanger the mother's life, since the possibility of saving both has been demonstrated and the method of operating explained by several obstetric surgeons who have become renowned by success.

SYMPHYSIOTOMY.

The fact that the pelvic symphyses become relaxed during gestation, and that in rare instances the pubic bones are found widely separated or even torn apart after severe labor, was known at a very early period in the history of medicine. Hippocrates, Galen, Avicenna, and others taught that the pelvic joints opened in labor from relaxation of their ligaments. As early as A. D. 1319, Jacques d'Ambroise, an anatomist of Paris, demonstrated it on the body of a woman who had been executed for infanticide a few days after delivery. The celebrated anatomist Vesalius taught it in 1564, and Severin Pineau wrote about it in a work which he published in 1598, and which went through many successive editions, one of which is known to have fallen into the hands of Sigault of Angers, and was no doubt the cause of his turning special attention to the possibility of still wider opening the superior strait by the knife—a practicable feature that was hinted at by Pineau. The train of thought put in action by the reading of Pineau's book set Jean René Sigault, then a medical student, to investigating the subject practically, which he did very imperfectly upon the bodies of several women who had died in labor, his dissections having been made too long after death to give a full idea of the measure of pubic separation attainable in a living parturient woman. Had he known of the possible widening of the incision to two and a half inches, which he rated at one inch, he might, perhaps have received more attentive treatment at the hands of his judges.

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[1] *American Journal of Obstetrics*, September, 1888, pp. 929–931.

Full of his subject, Sigault prepared a memoir upon it, which he sent to the Royal Academy of Surgery of Paris in December, 1768. Claiming for his operation a possibility of largely superseding the Cæsarean section, based upon a series of trials by which he could only show, as stated, an average pubic separation of an inch, his paper failed of accomplishing its purpose and he was looked upon as a visionary schemer. Not convinced, by any means, of erroneous reasoning, he made his plan the subject of his thesis at Angers in March, 1773, and subsequently defended it in Paris, where he applied for a license.

In 1773, M. Alphonse Leroy, professor of obstetrics in the École de Médecine of Paris, was led by the claims of Sigault to repeat his experiments, and, being fortunate at last in obtaining permission to operate on a Mrs. Brasseur soon after her death under the care of a midwife, he obtained a pubic separation into which he inserted his four knuckles, computed to measure 2½ inches Fr. (about 2¾ inches Eng.) This made him a convert to the opinions of Sigault, whose cause he advocated, and with whom he divided the responsibilities and risks of the initial operation, and subsequently its honors.

In 1769, Mrs. Souchot, the wife of a soldier, deformed by rickets and measuring 4 feet ¾ inch (Eng.) in height, came under the care of M. Sigault in her first labor, who, finding her pelvis deformed, called in Dr. Piet, by whom she was delivered of a dead fœtus with a quite elongated head after a moderate degree of traction on its body. On May 2, 1771, assisted by Drs. Thevenot and Coutouly, he delivered her by the crotchet of a second fœtus. The third child was at eight months, and extracted by the crotchet with less difficulty. On Easter, 1775, Dr. Sigault had the advice and counsel of eleven accoucheurs, only one of whom, Thouret, was willing that he should operate by pubic section: the fœtus presented by the hands; the feet were brought down, and five or six accoucheurs pulled in succession until in three-quarters of an hour the elongated head was brought through as at the first labor.

On September 30, 1777, Mrs. Souchot was in labor for the fifth time, and Dr. Sigault called in Prof. Leroy, who agreed to divide with him the responsibility of the proposed delivery by pubic section and assist him in it. Dr. Sigault accordingly operated on October 1st, and Prof. Leroy delivered by the presenting feet a living male child, the whole operation requiring not more than four or five minutes. The case was reported at the meeting of the Faculty of Medicine held on the evening of the day of operation, and a commission was appointed at the request of Dr. Sigault to examine the woman and watch the progress of her convalescence. The patient made a very slow recovery, and evidently, from the record, was in a disgusting condition, being deluged with urine from a wound made in the urethra by carrying the incision with the scalpel too far through the pubic arch. This accident was long overlooked, and the wound resulted in a urinary fistula which remained permanent and leaked except when she was in a sitting position. She became weak and emaciated, and from want of a proper appliance for keeping the pubic bones in juxtaposition they were many weeks in becoming reunited. At last she was well enough to be presented at a meeting of the Faculty of Medicine, and great honors were done to the operator and his assistant in the form of granting a decree and the presentation of medals: the dean, under instruction, petitioned for the granting of pensions from the Crown to the operator and patient; which was accordingly done. This bestowal of honors created much excitement in medical circles in Paris, and parties were formed in favor of and antagonistic to the new operation, which was praised overmuch on one side and somewhat underrated on the other.

The value of symphysiotomy as a substitute for the Cæsarean section was far from being satisfactorily established by the result in the Souchot case. Drs. Sigault and Leroy claimed that the sacro-pubic diameter under instrumental measurement was established to be 2½ inches Fr. (about 2¾ in. English), while Piet, Lauverjat, and Baudelocque stated that there was a little to the left of the sacral promontory a working space of 3 inches for the bi-parietal diameter of 3½ inches to pass through. Dr. Piet, who delivered the first child by the feet, stated that it was a larger one than the fifth, notwithstanding which he had experienced no greater difficulty in its extraction than he had had in the cases of a number of other women who had subsequently given birth to living children. The fact is, that Mrs. Souchot had an asymmetrical pelvis, with the sacral promontory deflected to the right, and the more open portion of the superior strait was to the left of it: her lower pelvis was ample for the birth of a fully-developed living child. Had her superior strait been a reniform, symmetrical one of 2¾ in. conj.

(*Eng.*), the rapid delivery of the fœtus would have probably produced its death and have done injury to the sacro-iliac synchondroses. The case was by no means a typical one for a 2¾-inch conjugate and a rapid delivery.

The public excitement produced by the result to mother and child under the initial operation occasioned the production of many critical monographs, and numerous tests were made upon the dead subject; which experiments, being usually tried too long after death, were entirely unreliable. Little attention was paid to the gains in the transverse and oblique diameters, the whole being directed to the small fraction that might be added to the true conjugate by each inch of pubic separation. The possibility of a wide separation without laceration of one or both sacro-iliac synchondroses was denied on the fallacious post-mortem experiments instituted upon the too rigid body; and it was not until the whole excitement had subsided that proper and satisfactory tests were made and relied upon. Drs. Girard of Paris and Ainsiaux of Liège, in 1800 and 1811 respectively, turned their attention to the test as made by Prof. Leroy in 1774 upon a woman recently dead in labor; and the latter obtained as high as 3 inches under the same circumstances, but failed to get more than 1¼ to 1½ where the woman had been dead thirty-six, thirty-eight, forty-eight, or fifty-four hours. Dr. Girard had met with similar results.

Symphysiotomy was largely original with Sigault, so far as it was intended to be applied to the living woman, but it had been performed after death more than a century earlier. Dr. Jean V. C. Delacourvée of France, when practising in Warsaw in 1655, thus delivered a woman of forty-eight who had died after a labor of four days; and Prof. Jos. Jacques Plenck of Buda, Hungary, in 1766 repeated it for the liberation of a locked head, found in making a post-mortem Cæsarean section. It does not, however, appear to have entered into their minds that such an operation might be of value during the life of the subject. Pineau appears to have been the only one before Sigault who ever entertained such a thought, and he is believed to have been scared at the suggestion.

After Sigault's operation on Mrs. Souchot became known in Europe there were many to repeat the experiment, and in 1778 no fewer than eleven pubic sections were made in Prussia, France, Belgium, and Bavaria. Of the 11 women, 5 died, and all of the children perished but 1: in but 2 women was the sacro-pubic diameter as short as in the Souchot case, and both died. In Case 8, under Prof. Guerard of Düsseldorf, the measure was the same as in Mrs. Souchot's, and the feet likewise presented. Mark the contrast: one leg was pulled off; cranium opened; delivery partly by crotchet, and finally by the natural forces; operation and delivery eight hours; woman died in eleven days. Four of the five women lost are noted as having died of gangrene of the genitalia; the cause of death in the fifth is not stated.

The eleventh and last case of 1778 was the fifth and last of Dr. Sigault's own operations, and occasioned as much unfavorable reflection as the first gave him reputation. Mrs. Vespres was a dwarf of thirty inches in height (about 2 feet 8 inches Eng.), with a seriously deformed pelvis, and had always walked upon crutches, who came under the observation of Dr. Sigault several months prior to her labor, and was decided by him to have a sacro-pubic measurement of 2 inches. When in labor on November 15, 1778, and examined under the disadvantages of a foot presentation by the fingers, the accoucheurs Coutouly and Lauverjat were of the opinion that she had 2½ inches (2¾ Eng.) in the conjugate, and on account of her asymmetrical contracted pelvis advised the Cæsarean section, believing that the pubic section must prove fatal to the fœtus. Being opposed in opinion by four other consultants, who sided with Sigault, she was delivered by him under symphysiotomy, after the employment of much force, of a moribund fœtus twenty inches in length. The mother died in great suffering five days later, and a careful autopsy showed a lacerated gangrenous perineum, a gangrenous vagina, and a separation of the ilium from the sacrum on the right side, with the periosteum detached; a partial mortification of the uterus and bladder, with a collection of sanious pus beneath the muscles of the left iliac fossa. The sacro-pubic measurement was found to be only 22 lines Fr. (about 2 inches Eng.).

The disastrous result of this attempt to make his pubic section a substitute for the Cæsarean operation in an extreme case of pelvic deformity checked the ardor of Sigault to such a degree that he subsequently declined to operate in a case having a 2¾ inch (Eng.) conjugate. In fact, he closed his career as an operator with this case, having saved 4 out of 5 women in thirteen months, and lost 4 out of 5 of their children.

In 1779 the failures of the first year began to affect the popularity of the operation, and the number fell off to five, under which all of the women and two of their children were saved. Prof. Alphonse Leroy took up the work abandoned by Sigault, and operated also five times—viz. twice each in 1779 and 1785, and once in 1804. He was more successful than his colleague, saving 4 women and 3 of their children. All of the cases had sacro-pubic measures above 2¾ in. (Eng.) but one, and that was fatal. Two were over 3 inches, one being 3½ (Eng.), and a third was 2⅞ in.

In 1780 there were 2 cases; in 1781, 3; and 1782, 1, in all Europe. In several subsequent years there was as high as 4, but there was a gradual decline until the operation died out for a time in 1858. Prior to its revival in Naples in 1866 there were 86 operations in eighty-eight years, 35 of which were in the first decade. In 1781 the operation was introduced into Italy by Dr. Antonio Lavaguigno of Genoa, and into Naples in 1787 by Prof. Domenico Ferrara, who performed it at its present centre, the Hospital for Incurables. In 1818 it began an almost exclusive career in Naples, there having been since that date but four Italian operations performed in other cities, as far as I can ascertain, and but one in any other country (Holland, in 1830). This has arisen from the fact that there is an abundance of cases of pelvic deformity to be delivered, and that but 2 out of 27 women recovered after the Cæsarean operation between 1791 and 1875 in that city, although all of the children were extracted alive.

Distribution of Cases.—The 86 cases are credited to the following countries: viz. Italy, 39; France, 32; Holland, 6; Belgium, 4; Prussia, 2; Bavaria, 1; Spain, 1; and England, 1 = 86. The results of the operations are as follows: Women recovered, 57; died, 29; children extracted alive, 29; moribund, 7; dead, 45; condition not mentioned, 5. France saved 22 women out of 32, and lost 25 children; Italy saved 25 out of 39 women, and 15 of their children. A very marked contrast to these results will be shown when we come to record the operations performed in Naples since the revival of symphysiotomy in 1866.

Sigault performed the first pubic section with an ordinary long-pointed dissecting scalpel, hence his cutting one crus of the clitoris and the urethra. The probe-pointed bistoury next came into use for the section of the ligamentous portion after opening the mons Veneris with a scalpel. Then a short incision was made above the pubes, the bistoury passed down behind it, and the bones separated from below upward and within outward, as is done at the present day. The knife now in use is a strong, sickle-curved, probe-pointed bistoury, known as the *falcetta* of Galbiati, from its inventor, Prof. Gennaro Galbiati, who performed the operation of Sigault (1815–40) sixteen times, saving 8 women and 4 children, being one of the accoucheurs of the Ospedale dei Incurabili of Naples. The invention of the knife is much more to his credit than the murderous operation known as bi-pubiotomy, which he made trial of upon a dwarf 3½ feet high on March 30, 1832, having a conjugate of only 1 inch. In order to widen the pelvis antero-posteriorly, so as to make room for the fœtus to pass, he cut through the horizontal and descending rami of the ossa pubes subcutaneously with a chain saw. He succeeded in delivering the woman of a dead fœtus, but in doing so severely cut the opposing soft parts with the sharp edges of the sawn bones, as may be readily inferred. The patient died in great suffering four days later of gangrene of the vulva, vagina, and adjacent tissues. Strange at it may appear, Dr. Nanziante Ippolito tried the same expedient in the Hospital for Incurables in the winter of 1842–43, with a similar result; and a recent writer has proposed the same operation.

As the rachitic pelvis is often asymmetrical, it is imporant to cut the symphysis according to its central line of direction. In several cases on record the knife was made to slice off a piece of one pubic bone, as was once done by Prof. Leroy in a subject that subsequently died of gangrene of the intrapelvic parts. The exsection of a bone-fragment retards the process of healing, as the piece may become carious and be discharged or require removal. In the oblique pelvis of Naegele, where one sacro-iliac symphysis is ankylosed, or in that of Robert, where both are so united, the operation is impracticable. It also is inapplicable in atrophy of one ilium with ankylosis due to early coxalgia, with consolidation of the hip-joint, the superior strait being D-shaped.

It is impossible now to secure a record of all the cases of symphysiotomy belonging to the first period—*i. e.* 1777 to 1858—although my record is as full as that of any collection of cases made at an early day. In 1806, Penchienati and Brugnone stated that there were 34 operations from 1777 to 1785, with 23 mothers and 11 children saved. Baudelocque collected 25 for the first five years: these we now have. In 1841, Dr. Fleetwood Churchill, with his usual inaccuracy, gave the number of operations as 49 and deaths at 16, when he should have found 78, with 26 deaths. Although there must have been an abundance of material in Naples for the operation, it fell off to such a degree in numbers that in the thirty years from 1828 to 1858 there were only 19 cases, 11 of which were under one and the same operator.

I have thus carefully drawn up the history of the rise and decline of symphysiotomy in what may be denominated its *first period*, and have not failed to record the measure of its fatality to the women operated on, which is only exceeded by that of the hastily-delivered children. There is nothing in the results attained, we should think, to induce any one to revive the operation in the hope of largely reducing the proportion of deaths in both mothers and children, and it required even more boldness and self-confidence to do this than it did for Dr. Sigault to perform the first operation in the hope of saving Mrs. Souchot and her fœtus. Still, it was done under Professors Morisani and Novi, and we have now to record the marvellous revolution in results attained by the operation under its second period.

Second Period.—In the last decade of symphysiotomy in Naples,
sing with 1858, the operations amounted to only 5, saving 4 women
3 children. It is generally supposed that in the next eight years
ing the "resurrection" of the operation, as Prof. Mangiagalli of
calls it, there were no cases in all Italy; but my friend and
ndent, the late Dr. Cesare Belluzzi of Bologna, wrote me that

he had operated in 1863 and 1865, with fatal results to the two women, but saving the children. The first died of pneumonia, with gangrene of the symphysis pubis, in thirteen days, and the second of peritonitis, having an uninjured pelvis, in six days. There were then in all Italy 7 operations in twenty years prior to January 5, 1866, and there have been no fewer than 70 in the twenty years commencing with that date. The 7 operations saved 4 women and 5 children, and the 70, 53 women and 55 children, 40 women and 41 children having been saved out of the first 50 in the Ospedale dei Incurabili of Naples between the date given and the close of 1880. These 50 operations, saving 80 per cent. of the women and 82 per cent. of the children, fairly represent the possibilities of symphysiotomy when judiciously undertaken and skilfully performed.

In view of the former record of the Sigaultian operation and its reputation as a surgical failure, its present local status appears almost incredible. Still, here are the facts, taken for me from the hospital record and attested by Profs. Morisani and Novi in their monographs on the operation. As in the Sänger Cæsarean operation, so in this, there is a remarkable connection between fœtal and maternal mortality —not so marked in cases of pubic section as in the Cæsarean, but still there is the relative diminution of death-rate. There is also this that does not so readily appear: the woman is less injured than formerly by pelvic strain; has a better and more rapid convalescence, less lameness, and better subsequent health. Under the original system, of turning and rapidly delivering the fœtus, not only was the life of the child endangered by the traction, but the sudden opening of the pelvis strained the sacro-iliac synchondroses, giving rise to serious if not fatal results; hence inflammations ending in gangrenous destruction of pelvic organs and tissues and the formation of abscesses. By the improved method, according to the direction of Morisani, the forceps will only be required in about one-fourth of the vertex cases, and the others should be permitted to deliver themselves; turning ought to be avoided where the head can be made to engage in the superior strait. Of the first 50 cases since 1866, 45 were presentations of the vertex, and 41 of the children were delivered alive. The other 5 deliveries were by the feet, and every fœtus was lost; 3 were breech presentations, and 2 were of the right shoulder.

In the next tabular record (18 cases) of the same hospital we find marked departures from the above carefully-considered rules, and an increase of the death-rate from 20 to over 40 per cent. in the women. There were 17 presentations of the vertex, and 1 of the feet; 13 of the former were delivered by the forceps, with the loss of 7 women and 1 child; 2 vertex cases were delivered by turning, losing 1 woman and both children, and 2 children were destroyed by instruments, 1 before and the other after the operation. Under the head of "observations" Prof. Morisani has marked opposite 3 cases "operation unjustifiable." If the fœtus is hurriedly drawn into the world, it is safer for it to be extracted with the forceps than by the feet; but it is far safer for the mother, if possible, to be delivered slowly and by her own natural forces than by either. The chief danger to the woman appears to lie in a *rapid* forcible extension of the sacro-iliac ligaments; the same accomplished by slow degrees is attended with less risk.

Since the revival of symphysiotomy in Naples twenty-two years ago there have been 76 operations in that city, and 1 in Asti, under which 58 women and 59 children were saved. These with the cases (86) of the first period make 163 operations, with 115 women and 88 children saved; 115 of the entire number belonging to Italy alone, and 48 to the rest of Europe.

In 1867, Prof. Enrico Jacolucci of Naples, who performed the last three operations of the first period, proposed a combination between the introduction of premature labor and the operation of pubic section in one class of extremely deformed cases, and between the same and craniotomy or cephalotripsy in another and still more deformed class. Acting upon these suggestions, Prof. Novi has several times, to avoid the Cæsarean section with its great fatality in Naples, combined symphysiotomy and craniotomy; and Prof. Morisani relates a very remarkable experience in the association of the introduction of premature labor with section of the pubes. Prof. Novi induced labor in the seventh month where the conjugate measured 54 mill. (2⅛ in. Eng.). Unfortunately, it was a shoulder presentation, and the fœtus, being delivered by turning, lived but an hour: the woman recovered in fifty days. In a second case the woman fell in labor at full term, having a sacro-pubic measurement of 49 mill. (less than 2 in. Eng.), and the fœtus was dead. Here the symphysis was opened, the head perforated and crushed, and delivery then completed. The woman recovered in forty-two days.

The case of Prof. Morisani is one of unusual interest and requires a more detailed statement. Lucia Esposito, a rachitic dwarf, aged twenty years, 3 feet 7¾ inches high, conjugate $2\frac{3}{16}$ inches (5½ cm.) entered the Clinica Ostetricia on May 15, 1880, in the seventh month of her pregnancy. The extent of her deformity being ascertained, it was determined to bring on labor in the first week of the eighth month. This was done on June 9th, and on the 11th, when sufficiently advanced, the pubes was opened. Head presented in first position of vertex; began to descend, passed into the pelvic cavity, was delayed at the perineum, and finally escaped by the vulva. Fœtus began to breathe regularly; it measured 15¾ inches long and weighed 4¼ pounds; occipito-frontal diameter, 3½ inches; occipito-mental, 4¾; biparietal, 3 inches (7.5 cm.); and bitemporal, 2⅜ inches. Child when three days old was nt to a foundling hospital. The wound was dressed with a compress ept moist by a drainage-tube leading from a vessel of hæmostatic water, nd by the end of a week the pelvis was fixed in an immovable apparatus ith an opening over the wound. Union was complete in thirty-four days, and in forty days she left her bed, being soon afterward ready to be presented at the clinic, having no pain or inconvenience in walking. Photographic pictures of this woman, presented by me to the College of Physicians of Philadelphia, fully attest the character of her deformity.

Symphysiotomy cannot take the place of the Cæsarean section and its modifications except to a very limited extent. It has a range of only a fraction over half an inch. By common consent of the best operators the minimum conjugate for safe delivery has been fixed at 67 millimeters, or $2\frac{5}{8}$ inches, and the maximum in 68 cases in Naples was 81 mill. or $3\frac{3}{16}$ inches. There were 2 operations at 61 mill. ($2\frac{7}{16}$ in.), 1 at 66, 18 at 67, 1 at 68, 4 at 69 ($2\frac{3}{4}$ in.), 20 at 74 ($2\frac{15}{16}$ in.), and 20 at 81 mill. Of the first 50 cases there were 10 deaths—viz. 5 out of 15 having a conjugate of $2\frac{5}{8}$ inches; 4 out of 15 where it measured $2\frac{15}{16}$ in.; and only 1 out of 13, where the c. v. was $3\frac{3}{16}$ inches. In the second record, of 18 cases with 8 deaths, there seems to have been little connection between the measure of deformity and rate of mortality—c. v. 67 mill., 3 cases, no death; c. v. 68 mill., 1 fatal; c. v. 74 mill., 5, deaths 2; c. v. 81 mill., 7 cases, 4 deaths.

Causes of Death.—These are quite different from those under the first period: Metro-peritonitis, 3—1 after four days' labor; septic metro-peritonitis, 1; peritonitis, 2; iliac phlegmon and metro-peritonitis, 1; endocarditis in twenty-four days, 1; endocarditis and diphtheritic vaginitis, 1; pelvic tumor and long labor, 1; hemorrhage from uterine inertia, 1; puerperal infection, parametritis, pelvic abscess, tetanus, 1; gangrenous endometritis, 1; exhaustion from long labor and repeated applications of the forceps, 1; not stated, 4 = 18.

Method of Operating.—Cleanse the genitalia and vagina with a wash of bichloride of mercury, 1 part to 2000; shave the mons Veneris; ascertain the centre of the symphysis pubis by finding the spines of the ossa pubes and the intermediate point between them; make a vertical incision of about an inch in length, down to the suprapubic centre; introduce the blade of a Galbiati knife behind the symphysis and force down its probe-pointed end until it can be felt under the pubic arch; then raise the handle and cut from below upward and from within outward until the bones give way and begin to separate. If the head presents, allow the woman to deliver herself if she can; too feeble in power, aid gently with a Davis or a Sawyer forceps, as e have blades which occupy but little space when applied. After delivery is accomplished sew up the suprapubic wound and bring the separated pubic bones together by long strips of adhesive plaster raised from the mons Veneris by a roll of bandage placed upon either side. When the wound is healed put on an immovable apparatus for fixing the pelvis. Treat the patient aseptically, as after an ordinary parturition, for the purpose of avoiding metro-peritonitis, the most frequent cause of death.

Symphysiotomy has never been performed in the United States, but there is no reason why it should not be as an alternate to craniotomy. Pelvimetry carefully performed may show that a pelvis is just a little too small for the passage of a living child in a woman already in labor. Craniotomy may be performed without very great risk, as the head will require but a moderate reduction in size to enable it to pass. The forceps does not answer, as it cannot make a sufficient reduction and the head is strongly ossified. The experience under skilled hands in Naples shows that in just such cases symphysiotomic delivery resulted in death from metro-peritonitis in only 1 subject out of 13, a woman of forty who had been four days in labor. Is there not an occasional case in our country where the value of the life of the fœtus is worth this degree of risk? A justo-minor pelvis may be found in a lady who is very anxious for the birth of a living child: she is too far advanced in gestation to be delivered prematurely; in fact, may be already in labor. Will you destroy her fœtus or open her pubes subcutaneously and let her deliver herself? Dr. Robert Barnes of London claims that the women are crippled for life by the operation. Prof. Ottavio Morisani, who is a much higher authority, has written me quite the opposite. He says: "The immovable dressing secured the firm union of the symphysis pubis in all the cases that recovered," and "that the women had good health after the operation;" that "phlegmasia dolens did not occur in any of the 50 women," and that vesico-vaginal fistula occurred in but 1 case, which was easily cured by an operation. "The separation of the pubes in these 50 cases amounted to 50 mill. (about 2 inches), which was obtained without any effort and without producing any lesion of the sacro-iliac synchondroses." The operation is a less formidable one to a woman than gastro-hysterotomy, which does not seem to be justified under the amount of deformity named. In the Porro and Sänger operations of Europe the sacro-pubic diameter has generally been computed at 2½, 2¼ inches, or less, and the degree of pelvic deformity has but little to do with the final result of the case. But with symphysiotomy, on the contrary, much must depend upon the length of the true conjugate, and with proper care and skill the risk will diminish as the working space in the pelvis increases. The greater the disproportion between the size of the fœtal head and pelvis, the greater must be the strain upon the sacro-iliac connections, and *vice versâ*. Hence the vital importance of making an accurate measurement of the pelvis before deciding upon the practicability and prospective risk of the operation. As a very small woman may bear a large fœtus with an overgrown head, there is always an additional difficulty to be considered in the fact that the size of the head cannot be estimated before birth. The prognosis, then, must have always an element of uncertainty in it, making it all-important not to risk an operation in a case with a very small conjugate. If the operation is ever to be tried in the United States as a substitute for craniotomy, the initial case should be one that gives a fair prospect of success to mother and child. I heard an accoucheur say recently that he had delivered twenty-four children under craniotomy. No doubt in this number there must have been one or more cases adapted to delivery under the pubic section with safety. I am confident that I met with such cases in the hands of distinguished accoucheurs years ago when there was less conscientiousness about craniotomic infanticide than there is now, and apparently more demand for it in the less prevalence of the employment of well-fitting forceps. There are physicians who ease their consciences by never performing craniotomy until after the fœtus is dead: are they entirely guiltless, then? Is it not the duty of such men to try to save both child and mother if this can be effected by the Sänger operation or the method devised by Sigault and rendered much less fatal by Morisani?

Symphysiotomy is not as simple an operation as many might suppose, and ought to be carefully studied upon the dead subject. The tissues are softer and most easily cut, upon the parturient woman or one that has died in or soon after labor. The Galbiati knife has been introduced into our country, and I know of several accoucheurs who have it, and who may make a trial of the operation when a suitable case presents itself. One woman in Ohio now rejoices in a living child, saved for her in hospital by the improved Cæsarean section after the loss of three children under craniotomy. In a proper case this may be done under the pubic section with the same result.

(For many historical facts of the early days of symphysiotomy I am indebted to the valuable collection of special monographs by Sigault, Leroy, Piet, Lauverjat, Baudelocque, and many others in the Lewis Library of the College of Physicians of Philadelphia.)

LAPARO-ELYTROTOMY.

Until within the last six years, and most decidedly within the last two, in which German, Austrian, American, and other successes have taught a different lesson, the Cæsarean operation in its true type was regarded by many as the most fatal in surgery, and, as opening the peritoneal and uterine cavities was looked upon as lying at the foundation of the risk, plans of delivery under the knife by which both of these dangerous exposures might be avoided were at different times devised during the last eighty years. As it was long known to anatomists that the cervix uteri might be reached from the lower part of the abdomen beneath the peritoneum, it became a question for consideration whether delivery might not be accomplished through the flank and the vaginal wall subperitoneally.

The first who is known to have conceived of this idea, although he never tested it in practice, was Prof. Johann Christian Gottfried Jörg of Leipzig, whose proposition dates back to 1806. The main idea of this German obstetrician was to avoid the danger of opening the body of the uterus by incision, which he believed to be the great *fons et origo mali;* and to do this he proposed to open the abdomen through the linea alba, so as to reach the vagina, and then incise it, extending the vaginal opening, if space should require it, into the cervix. Cervico-vaginal lacerations permitting the fœtus to escape into the abdominal cavity have not been uncommon, and perhaps this has been the least fatal form of uterine rupture. One of these accidents came under the observation of Prof. Jörg, and led him to think of delivery in the same direction by incision. Had he used his knife at the point and in the manner proposed, he would have discovered that an accidental laceration was less provocative of fatal hemorrhage than a clean incision.

The second to enter upon a somewhat similar line of thought, and influenced to do so by the teaching of Jörg, was Prof. Ferdinand Franz August von Ritgen of Giessen, who in 1820 proposed an improved method of operating which he learned in part from the subperitoneal method of ligating the external iliac artery. His plan was to make a curved incision in the abdomen on the right side from the region of the crest of the ilium down to a point near the symphysis pubis, at a distance of an inch from the bones, through the skin and muscles to the peritoneum. This membrane was then to be lifted from the iliac fossa, the vagina brought into view, and an opening made into it for the delivery of the fœtus: he also proposed to follow the plan of Jörg in enlarging the opening of the vagina by incising the cervix uteri to gain room for the passage of the fœtus if such should be required.

In putting this plan into practice in 1825, Prof. Jörg made trial in a case of malacosteon affecting a multipara, and progressed satisfactorily until he attempted to enlarge his vaginal incision (which he had made an inch and a half long with safety) toward the cervix by the knife, when such a violent hemorrhage was provoked that he was forced to desist and to deliver the woman by the Cæsarean operation. The child was saved, but death resulted in the woman from hemorrhage in fifty-eight hours coming from the gaping uterine incision, the uterus having been relaxed by inertia to a length of eleven inches.

Failing in this attempt to perform a true laparo-elytrotomy by reason of not opening the vagina by laceration, Prof. Ritgen did not learn that the vagina alone would provide a sufficient opening for the passage of a fœtus, but conceived the idea that to gain space it would be necessary to split the anterior lip of the uterus its entire length. It appears singular to us now, that these two men failed to make the proper application of what they were taught by the case of rupture, and to tear the vagina open to avoid hemorrhage.

The third proposition was made in the thesis of Auguste Baudelocque —later in life Prof. Louis Auguste Baudelocque of Paris — which he presented before the medical faculty in 1823. In this he proposed to open the abdomen in the linea semilunaris down to the peritoneum, the incision to extend from a point opposite the umbilicus down to within two inches of the pubes. The peritoneum was then to be separated from the iliac fossa by a finger entered at the lower angle of the wound and worked outward and upward. One assistant was then to hold up the peritoneum, and another to fix the uterus, while the operator was to feel for the arteries surrounding the vagina; to tie them at both ends; then to force out the anterior vaginal wall by means of a hand in the vagina, carrying it through the wound, when he was to incise it to the extent of four and a half inches, avoiding the part near the cervix. The delivery was then to be left to nature, or, if requisite, the forceps was to be employed.

Prof. Baudelocque operated twice, but was in neither case able to carry out his proposed plan. The date of his first experiment has not been given. The woman was a rachitic dwarf, thirty-nine inches high, with a conjugate of $1\frac{3}{4}$ inches. On puncturing her vagina to commence the incision in it he started such a violent hemorrhage that he was forced to desist, tampon the wound with sponges, and complete the delivery by the Cæsarean section: the child was lost, and the woman bled from both vaginal and uterine wounds until she died.

His second trial was on May 6, 1843, the subject being affected with eclampsia and having a conjugate of nearly 4 inches, the child also proving to be dead. Fearing a repetition of his first experience, and not knowing the value of laceration over incision as a means of avoiding the vaginal hemorrhage, he passed a needle around the left external iliac artery (this operation, as well as the former one, being on that side); but just at this point the assistant unfortunately let drop the peritoneum; he could not for a moment see the needle, the internal iliac was pricked, and he was forced to ligate the primitive iliac. He then incised the vagina as proposed in his thesis, and turned and delivered the dead fœtus: the woman died in seventy-four hours of septic peritonitis. This operation appears to have been entirely unjustifiable, as the fœtus was dead and the pelvis not deformed. If laparo-elytrotomy was possible, craniotomy should equally have been on the dead fœtus.

The fourth proposition was made by Prof. Philip S. Physick of Philadelphia in 1822 to Dr. William E. Horner, the anatomist, who sent it in 1824 in a letter to Dr. William P. Dewees, by whom it was introduced into his work on obstetrics, then passing through the press in its first edition. The plan proposed was to open the abdomen by a transverse incision above the pubes; to separate by careful dissection the peritoneum reflected over the bladder, which viscus was to be somewhat distended, so as to expose the cervix uteri where it is not covered by this membrane; and then to incise the cervix so as to give exit to the fœtus. Fortunately for the credit of the originator, his plan was never put into practice, as it would have greatly endangered the integrity of the peritoneum, and have necessitated the opening not only of the cervix, but of the vagina at dangerously vascular points, and have no doubt ended fatally to the patient experimented upon.

The fifth proposition was that of Prof. Sir Charles Bell of Edinburgh, introduced in 1837 into his *Institutes of Surgery*, a manual prepared for the students who attended his medical lectures. His plan of reaching the vagina was that of Ritgen, but here he made the important change that it was not then to be opened, except very slightly, by incision. His directions are these: "Make a small incision; introduce the finger; dilate slowly; imitate in this the natural labor; there would be neither pain nor danger by delay" (p. 342). He made a similar proposition with regard to opening the uterus in the Cæsarean operation some years earlier, and evidently held the opinion that the uterine or vaginal tissue could be dilated from a small incision to a large opening as the os uteri dilates: he says nothing of tearing the parts, as was done at a later period by Thomas. It has been much more recently shown that an accidental trocar-puncture of a gravid uterus will very soon dilate into quite a large orifice.

Dr. Francesco Cianflone of Naples repeated the operation of Baudelocque in 1856, and lost his patient in twenty-four hours, but saved the fœtus. This was the only operation of the kind in Italy. Dr. Cianflone was one not to be deterred by a previous failure in other hands, as shown by his repetition of the murderous operation of bi-pubiotomy as devised by Galbiati, and with a like fatality, in 1854.

We come now to the revival of the operation in 1870, and its successful performance without hemorrhage by Prof. Theodore Gaillard Thomas of New York, who, strange to say, was not aware until after his initial trial that various attempts had been made to accomplish the same end in the preceding forty-five years. Prof. Thomas, regarding the Cæsarean section as "the most dangerous operation in surgery," and knowing well the anatomical relations of the peritoneum, uterus, vagina, lower abdomen, and pelvis, conceived the idea of avoiding what he believed to be the chief dangers of the old method by a subperitoneal entrance of the vagina and a delivery of the fœtus through the os uteri, a vaginal laceration, and the lower abdomen, as by the combined methods, unknown to him, of Ritgen and, in a measure, of Bell. He tested his plan upon the bodies of three dead women, one of whom was pregnant and had nearly reached the full term of gestation. Finding from the last case that the operation presented no material difficulties, he substituted it for the Cæsarean operation in a case to which he was called about a month later in the spring of 1870. The subject to be operated upon was in a hopeless condition from pneumonia and in a moribund state, while the fœtus was premature, and, as was shown upon delivery, not in a condition to live: both survived the operation about an hour. The whole time consumed in operating was about thirty-five minutes. Thus was accomplished without arterial ligation or severe vaginal hemorrhage a method of delivery which all his predecessors had failed in when making the attempt.

Method of Operating.—This has been now fully established by the work of five American operators, who have had collectively 7 successful cases, and may be stated as follows: The operating-room is to be warmed to a temperature of 75° to 80° Fahr., and it may be carbolized if thought desirable, but the use of spray during the operation is generally considered objectionable. The patient is to have her rectum and bladder well emptied, and her labor is to be so far advanced that her os uteri shall be either fully dilated or easily dilatable. The instruments, ligatures, and sponges to be used are all to be carbolized, the abdomen washed with warm water and soap, then with ether, and then with dilute carbolic acid or bichloride solution, and the vagina irrigated as already directed for the antiseptic Cæsarean operation. The operator is to stand on the right of the woman, and make his incision on the right of her abdomen, parallel with and a little more than an inch above Poupart's ligament, his chief assistant on her other side at the same time drawing up the skin of the abdomen to make it tense. The incision is to commence at a point one and three-quarter inches above and to the outside of the spine of the os pubis, and to be carried in a slightly curved direction upward and outward to a point the same distance above the anterior superior spinous process of the ilium, the wound measuring about five inches in length. The muscles being carefully cut through and the peritoneum exposed, the edges of the wound are to be secured against bleeding by the use of compressing-forceps, the chief vessel to be secured being the superficial epigastric artery. The peritoneum is to be carefully separated from the tissues overlying it to the full length of the incision, and is then to be peeled from the fascia transversalis and fascia iliaca, and lifted up until the vagina is brought into view near its uterine connection. It must here be borne in mind that in a case of extreme pelvic stenosis almost the whole internal operation is performed above the superior strait, into which the fœtal head cannot enter, the uterus, bladder, and expanded vagina being forced upward for want of accommodating space.

The second assistant, who stands to the left of the operator, now introduces his hands, guarded by a warm napkin so as to prevent slipping, and lifts up the peritoneum away from the iliac fossa with the superincumbent intestines, so as to open the parts to the eye of the operator, while the first assistant, opposite to him, draws the uterus upward and to the left side, so that the right side of the vagina shall be brought to view. The third assistant, at the left hip of the woman, holds a female catheter in the bladder as an indicator and to lift the viscus from the vagina, while the operator, with a round-ended wooden instrument, or, better still, with his fingers, forces up the vaginal wall into the wound, the sense of touch enabling him to avoid important arteries and large veins in making the vaginal puncture.

As the attempts to open the vagina with a knife proved so disastrous in the hands of Baudelocque and Ritgen, it has been proposed by Dr. Garrigues of New York to open by cauterization instead of incision; but this precaution has not been found necessary. The safest point for puncturing is about one and a half inches anterior to the cervix, and by the use of a round-pointed conical piercer and a pair of large dilators, such as are used for the cervix uteri, all cutting may be avoided if thought dangerous. In general, a very small puncture, and the index finger forced through immediately after it is made, will not be attended with any serious loss of blood. A second index finger is next to be forced through, and the two are to be forcibly separated, so as to lacerate the vaginal wall extensively for the passage of the fœtus, care being exercised not to tear too near the neck of the bladder. The point selected for making the puncture is chosen with a view to avoid the ureter and the larger vaginal blood-vessels.

The catheter is next to be removed, and the membranes, if intact, ruptured: the first assistant tilts over the fundus uteri to the left and backward, so as to cause the cervix to rise toward the groin, while the operator with his finger in the os lifts it in the same direction. The fœtus may now be allowed to escape by the contractile force of the uterus, or it may be requisite to deliver by version or the forceps, and, if dead, by other instruments. The placenta is to be expelled by compression and delivered through the wound.

When the uterus is fully contracted the tract through which delivery has been accomplished should be thoroughly cleansed by irrigating with warm carbolized water, the fluid escaping by the vagina; and particular care should be taken after a dead, and specially a putrid, fœtus has been removed. In case of hemorrhage from torn vessels ligation should be used; but if this is impracticable, cauterization may be accomplished through a non-conducting speculum: persulphate of iron may also be applied *per vaginam*. To test the soundness of the bladder, warm milk may be injected into it, as suggested by Dr. Garrigues, the color of the fluid indicating any tear in its escape—an important examination when it is considered that this viscus has been five times lacerated and once cut with the scissors in fourteen operations. Skill may, but will not always, prevent the tearing of the bladder, as it is impossible to regulate the measure of distension which the passage of the head will produce. When a rupture is discovered by the milk-test it should at once be sutured and a catheter worn until the wound is healed.

The last step in the operation is the closure of the abdominal wound, which is done by interrupted sutures of carbolized silk, as after ovariotomy, and the parts dressed antiseptically. The wound will only partially close by the first intention, and for this reason some operators have preferred to leave its lower angle open or to use an abdomino-vaginal drainage-tube. The time required in recovery has varied from two weeks to nine, the average being five weeks.

The directions given have been for a right-side operation, which was at one time thought to be a necessity in view of the position of the rectum—a matter not of any consequence, as shown by the fact that three left-side operations have been performed, and it so happened that the bladder was not torn in one of them. The possibility of a second operation has also been settled by these left-side cases. Women may be deformed in such a way that a left-side operation may be preferable or even imperative, as, for example, where a coxalgic ankylosis has fixed the right thigh across the side of the abdomen and shut up the groin.

Laparo-elytrotomy is not a difficult operation if in the hands of one who is conversant with the anatomy of the parts involved and knows by the eye and touch the tissues to be encountered. The normal relations of the ureters, vagina, and uterus should be known, but much reliance cannot be placed upon them in cases of extreme pelvic deformity where these viscera are greatly displaced. The time required in an operation must vary in accordance with the slow or rapid progress of the labor; the delivery has been accomplished in ten minutes, but may take the greater part of an hour if the os uteri should prove not to be easily dilatable. In some cases of pelvic deformity the cervix remains obstinately rigid and but slightly dilated for days together, and Barnes' dilators may not be available because of the stenosis: dilating the os after the incision may greatly retard the delivery.

The applicability of laparo-elytrotomy is much more limited than that of the Cæsarean section, as the integrity of the cervix is an absolute essential of success, for the fœtus must pass through it. This limitation is a marked feature in the American Cæsarean record, as fully one-third of the 175 cases were not proper subjects for laparo-elytrotomy. In European subjects, in whom pelvic deformities are almost the only recognized obstacle to delivery, this objection would not avail. For reasons not altogether understood, the successes of Brooklyn and New York in 1875 and 1877 did not for a period of eight years induce any Continental operator to make trial of the subperitoneal operation. Possibly, the Porro method, which came into notice at the same time, drew away whatever attention it might otherwise have attracted.

Statistical Record.—Laparo-elytrotomy since its revival and vital improvement under Prof. Thomas, eighteen years ago, has been performed 14 times, of which number 11 cases belong to the United States, 2 to England, and 1 (in 1885) to France. Of the American operations, 3 were performed in New York City, 6 in Brooklyn, 1 in Cincinnati, and 1 in Newport, Rhode Island. Prof. Thomas has had 2 cases; Prof. A. J. C. Skene of Brooklyn, 4; Prof. Charles Jewett of the same city, 2; and Drs. T. W. Hime of Sheffield, England, Arthur W. Edis of London, Walter R. Gillette of New York, N. P. Dandridge of Cincinnati, J. Poullet of Lyons, and W. Duncan McKim of Newport, each 1. 7 of the women recovered; 5 children were dead, and 1 moribund on delivery; 1 lived eighteen days; and 7 more are recorded as saved. Of the 7 fatal cases, 1 was operated upon when in a dying state, and lived only an hour; a second had a feeble pulse of 130, and had been forty-eight hours in labor, in which craniotomy had been attempted; she died of shock in seven hours; a third (Dr. Hime's) had cancer of the recto-vaginal septum, was addicted to habits of intemperance, and had been in her bed for eleven weeks: she died violently delirious in two hours; a fourth (under Dr. Edis) was in bad health and had œdema of her lower extremities: she died in forty hours; a sixth had been a week in labor, and died of septicæmia in seventy hours; and the seventh (Dr. Poullet's) was operated upon when in a favorable condition, but died of peritonitis on the eighth day. The children of the three European cases all lived.

The seven women who recovered were in labor, respectively, eight hours, eleven hours, sixteen hours, twenty-two hours, twenty-nine hours, four days, and a week; and all of their children were living except that of the last, which had been destroyed by craniotomy and was putrid. Prof. Skene saved 3 women and 4 children by his four operations. Of the 14 cases, 3 were hopeless when operated on, and 6 of the remainder quite unfavorable; still, one-half of the women were saved.

Prof. Thomas, although not the original projector of laparo-elytrotomy, was the originator of the scheme that robbed it of the fatality which had always attended its performance in the hands of his predecessors, and gave it the value that it now possesses. The key to success certainly belongs to him, and not to Sir Charles Bell, whose language cannot be made to teach vaginal *laceration* when he evidently intended to advise *slow dilatation*, as he had in 1813 in reference to the uterus as a substitute for the incision in the Cæsarean operation. He had a theory to put into practice, a trial of which might possibly have taught the feasibility of laceration; but to tear for the purpose of avoiding hemorrhage was evidently not the idea that actuated him. If by an accident in an ovariotomy you puncture the wall of a gravid uterus with the trocar in the later months of pregnancy, you may see, as Prof. Byford of Chicago did, the hole you have made dilate under uterine contraction to the size of a dollar in a few minutes. Sir Charles Bell assisted his brother John in a Cæsarean operation in the year 1800, and noticed that his initial incision in the uterus immediately opened to almost a round hole. The woman died of hemorrhage, and on autopsy it was found that the uterus had contracted in all parts except in the line of incision, which appeared to extend from fundus to cervix; the wound gaped open and had everted edges. Strange that his thoughts did not suggest the use of sutures, but they did not: his mind reverted to what he witnessed in the operation as the effect of muscular action in converting a straight cut into a round opening, and he conceived the idea that the uterus might be opened by puncture and a gradual manual dilatation so as to admit of the passage of the fœtus. What he taught in 1837 was simply the application of this idea to the vagina.

Prof. Thomas acted upon two well-known facts—viz.: 1, that lacerated wounds bleed but little in comparison with incised wounds in the same location or tissue; and 2, that accidental cervico-vaginal laceration in labor, although largely fatal, even after the fœtus has been delivered *per vias naturales*, owes its fatality not so much to hemorrhage as to shock and exhaustion; and it is well known also that this kind of laceration is, of all the forms of rupture in labor, the least mortal in its results, which may be attributed largely to its natural drainage.

Laparo-elytrotomy has been greatly overshadowed by the improved Cæsarean operation, but for which it might have been much more thoroughly tested. It is certainly less fatal than the old operation, and possibly less than the Porro method. It would require many more cases to compare its value with that of Sänger's operation.

PUERPERAL INFECTION.

By HENRY J. GARRIGUES, A. M., M. D.,

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Having been requested to write on Puerperal Infection, the first difficulty encountered was to define the limits of the subject. The view we now take of the dangerous disease which used to ravage lying-in hospitals, which yet is met with occasionally, and which is commonly known as puerperal fever—namely, that it is due to the entrance of microbes into the body of the puerperal woman—is so new that its foundation was only laid in the decade from 1870 to 1880 by the researches and experiments of Mayrhofer, Recklinghausen, Waldeyer, Orth, Heiberg, Haussmann, Spillmann, Kehrer, Hugh Miller, Pasteur, and Doléris.[1] Since then the question of microbes, their nature, their effect, their relation to certain diseases, and especially to the occurrences in childbed, have been considerably developed. Being in the middle of this period of investigation, we run a risk of being carried too far by the enthusiasm engendered by the light that after so many centuries of vain speculation has been thrown on the mysteries of that dread disease which used to surround childbearing with such gloomy apprehensions.

I think it can be looked upon as a well-established scientific fact that the more serious affections of childbed are due directly or indirectly to microbes, but, so far as I know, it is not yet settled whether the more benign forms of fever and inflammation that affect the puerpera have the same source or not. Still, the domain of the microbic theory seems to be widening more and more. Even insanity is by some attributed to sepsis.[2]

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[1] J. A. Doléris: *La Fièvre puerpérale et les Organismes inférieurs*, Paris, 1880, pp. 45–49.

[2] Hansen has examined 49 cases of psychic disturbance occurring during the puerperium: in 42 of them he found septic infection, in various degrees, present. He concludes that the majority of cases of puerperal psychoses are caused by septic infection or eclampsia: when in the early weeks of the puerperal period a psychosis characterized by acute hallucinations develops without a previous eclampsia, the diagnosis of puerperal septic infection is justified, even in the absence of fever and other symptoms ordinarily present in infection (*Am. Journ. Med. Sci.*, Nov., 1888, p. 547, from *Zeitschr. für Geburtshülfe und Gynäkologie*).

Under these circumstances I have agreed with the Editor that I should treat of all inflammatory conditions except the eruptive fevers, and leave the non-inflammatory affections of the nervous system, such as tetanus, tetany, and insanity, to another writer. In my own opinion what is thus left to me is so intimately connected that it is not possible to draw the line of demarkation within its limits; and yet this entails the essential unity of so different conditions as a swelling of a broad ligament referable to a tear of the cervix, or an inflamed inguinal gland affected by a lymph-vessel which connects it with an abrasion on the vulva—slight affections that, with proper treatment, in the vast majority will pass off in a few days; and of cases in which the most important organs are the seat of a widespread disease, or in which the whole organism is, as it were, hit by a thunderbolt, and the patient succumbs even before the organs find time to develop the usual inflammatory changes.

I abstain altogether from the use of the term "puerperal fever." Its meaning has never been clear. Since first it became known, toward the end of the last century, that the disease was contagious, nobody liked to admit that he had a case of the kind on hand. The suspicion of having brought the disease himself might attach to the physician, and in good conscience he could not attend to other midwifery cases; so that on all sides he was a loser, and it was in his interest to have the domain of puerperal fever restricted as much as possible. The most serious inflammations were not admitted as proof of the presence of puerperal fever. Even a general peritonitis might simply be traumatic, as the saying was. Only the very worst cases were looked upon as puerperal fever; the milder figured under the name of an inflammation of the organ most prominently attacked, or under that of septicæmia as something different from puerperal fever. In my opinion the term "puerperal fever" can as little retain its place on the nosological table as "brain fever," "lung fever," or "dropsy"—so much the less so as sometimes there is no fever at all. Other names have been substituted, such as "metria" and "puerperal septicæmia." The first of these words is rather vague, but points toward the uterus as the starting-point of the disease; and, although this generally is so, still infection with all its consequences may start from any other part. Septicæmia, on the other hand, is too strong a term. I, at least, cannot use it for the group of cases I am called upon to discuss in this article. Septicæmia means that septic material circulates with the blood and has infected the whole system. This term applies aptly enough to the most serious cases, and becomes then synonymous with puerperal fever in the sense in which most practitioners and laymen take it, but is by far more comprehensive than the term as used by those who think there is a special essential fever—a disease *sui generis,* which only attacks lying-in women, and differs from septicæmia as it appears in a wounded man or a non-pregnant woman. For the lighter cases, where the infection is arrested in or near the genitals, the word "septicæmia" could hardly be used with propriety.

In using the term "puerperal infection" I am well aware that it properly refers to the etiology, but I think we may quite as well use it to designate the effect of this cause, just as the word "cold" both signifies the morbific agent and the pathological condition produced by it. The word has the advantage that it points out where the disease comes from, and teaches us to take measures to prevent it. It covers the whole ground, severe and light cases, and this it ought to if Czerniéwski[1] should be found to be correct when he states that the micrococcus which does the mischief is the same in the mild and the severe cases of infection—namely, Streptococcus.

The difference in the symptoms and in the danger may be accounted for in many ways. Continued investigation, better instruments of observation, improved methods of cultivation may show that there are different species of microbes at work in different cases.

Perhaps the mere number of micrococci that invade the system make the difference. According to Pasteur, the innocuous micrococci that live in the vagina become dangerous if they are developed in great number and occupy the deep parts. They consume the oxygen found in pus, and thus clear the way for another class of microbes which cause infection. He therefore says: "Là où les germes abondant, là le danger existe"—where there is an abundance of microbes there is danger.

Perhaps the difference is due to the different organs to which the microbes are carried accidentally. Entering one lymphatic vessel, they may be carried to a neighboring gland, where they are imprisoned and kept until their death, or evacuated through an abscess opening on the surface of the body. Entering another, they may be carried to the peritoneal cavity, cause general peritonitis, and continue their route through the stomata of the diaphragm to the pleura and the pericardium. Others, again, may lurk in the thrombus of a vein, a piece of which is detached and follows the current of the blood up through the vena cava, the right atrium and ventricle, and the pulmonary artery, until it is arrested in a fine branch of the latter and causes an abscess, from which, again, other organs may be infected.

Still another way to account for the difference in the virulence of the cases is the different power of resistance of the patient. Of three men exposed to the same draught, one may escape with a cold in his head, the other with a stiff neck, while the third contracts a pleurisy which kills him. This may, indeed, have some influence, but when we take into consideration that by far the greater number of victims to puerperal infection are young, healthy primiparæ, we will not lay an undue stress on the previous condition of the infected person.

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[1] Czerniéwski: in *Archiv für Gynäk.*, 1888, vol. xxxiii., No. 1, p. 101.

Having united all cases supposed to be due to infection in one article, it is evident that the prognosis varies very much; but that will be pointed out in due time, and even with the light cases it is good to bear in mind that if not the likelihood, at least the possibility, of a bad turn and of the development of the most serious symptoms is connected with any case of puerperal infection.

The limits of the subject once decided upon, the next question that presented itself was how best to make use of the space destined for its discussion. Convinced that most of my readers will be intelligent men, already busily engaged in practice, but who have not had the advantage of training in a lying-in hospital, I have thought that I would best adapt myself to the special needs of the majority of them, and most further the welfare of their patients, by limiting the discussion of the nature of puerperal infection, its etiology, pathology, symptoms, diagnosis, and prognosis, to a brief indication of the most salient points, and to devote as much space as possible to a detailed description of the means by which infection is prevented and treated. The first part, I hope, will be circumstantial enough to give the reader a clear idea of what the disease in question is; in the second I strive to be his trustworthy guide in all the perplexities that beset an honest man who wishes to protect his patient from puerperal infection, or to cure her of it if she has already contracted it, and who has no hospital experience in this line to fall back on.

NATURE OF THE DISEASE.

Many have been the theories advanced about the nature of the more serious forms of puerperal infection, commonly called "puerperal fever."

Hippocrates, taking the effect for the cause, attributed it to the suppression of the lochia—a view that still found followers in the last century.

Puzos in France (1753) defended successfully the theory which had already been advanced by others before him, that "puerperal fever" was due to a metastasis of the milk. The fibrinous exudation found in puerperal peritonitis was taken for milk. If the patient developed phlegmasia alba dolens, the milk had settled in her leg. If delirium predominated, it was the milk that had mounted to her brain. If she contracted an arthritis, it was again the milk that settled in her joint. This theory, long time contemporary with the preceding one, survived its old rival. It has been believed by eminent physicians who are yet alive, and it is still the prevalent idea among the general public.

According to a theory at the time much credited by English writers, "3. It belongs to the class of zymotic diseases, and results from some unknown blood-changes.

"4. We are as ignorant of the specific cause of these blood-changes as we are of those which develop relapsing fever, scarlet fever, or any other essential fevers.

"5. The determining cause of this fever may be either epidemic influences, contagion, infection, or, probably, nosocomial malaria.

"6. Any of the local inflammations may occur in the puerperal woman without puerperal fever; and, on the other hand, puerperal fever may be so severe as to destroy life without sufficient local disease to account for the symptoms or explain the cause of death.

"7. The specific causes which develop the exanthemata, such as scarlet fever and smallpox, may develop the specific disease with intense malignancy in the puerperal woman; but this does not transform the disease into a puerperal fever.

"8. Septicæmia may be developed in a puerperal woman, either from autogenetic or heterogenetic infection, without puerperal fever, but this infection may also complicate puerperal fever."[1]

The common view now-a-days is that puerperal fever is identical with septicæmia and pyæmia occurring as a complication of wounds, and the idea begins to take shape that all inflammatory disturbances in childbed are caused by infection. The first opinion was already advanced by Eisenmann in 1837, and again by Sir James Y. Simpson in 1850.[2] Since then so many corroborative cases have been published that the identity between puerperal fever and septicæmia in the wounded may be looked upon as a proven fact.

As obstetricians it interests us particularly that identically the same disease which in puerperæ is called puerperal fever or septicæmia or puerperal infection is found in the newborn child. It may either be found in a child whose mother is similarly affected, or in the child of a healthy mother. The infection may take place through the placental partition, through the sores that so often are found in the mouth of the infant during the first days of its life, or through any accidental wound of the body; but the most common entrance is the physiological wound presented by the navel. It may also be produced by the aspiration into the lungs of putrid liquor amnii. The poison is most likely of parasitic nature. It may come from the mother, either through the placenta or the liquor amnii, but it may quite as well be brought by the doctor or the nurse, or cling to any object with which the child comes in contact; nay, perhaps it may even float in the air.

In 340 autopsies made by Runge in the lying-in department of the Charité Hospital of Berlin he found general sepsis in 36 cases. In 33 of these the infection had taken place through external wounds, and of this number it was in 30 through the navel, as proved by the presence of umbilical arteritis. In 3 there were accidental wounds. Thus, only 3 were left in which the poison must be supposed to have entered by an uncommon road.[1]

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[1] Fordyce Barker: *The Puerperal Diseases*, 4th ed., 1878, p. 476.

[2] *Edinburgh Monthly Journal of Medical Sciences*, vol. xi. pp. 414–429.

Credé, on the other hand, saw the infection take place from sores in the mouth in 9 children out of 10 who died of sepsis during a so-called epidemic of puerperal fever.[2]

That the less dangerous forms of puerperal inflammation are due to infection becomes probable by the modern investigations of bacteriologists, and finds a powerful corroboration in the clinical fact that since the introduction of the strict antiseptic preventive treatment, to be described later, these inflammations have become very rare, and have taken so benign an aspect that they can hardly be recognized as the same thing.

It is commonly believed that certain small organisms called microbes, germs, bacteria, or micrococci are the true cause of puerperal infection —a question which will be fully elucidated by another writer, who has made personal studies in this direction.

According to many authors, septicæmia is twofold—*heterogenetic*, when the poison is brought from without; *autogenetic*, when engendered in the body of the woman herself, but in the new light of bacteriology we cannot admit that the patient can produce any poison herself. All she does is to furnish the ground where the seed coming from without develops. Her lochial discharge, her bruised and torn tissues, the fluids stagnating in her genital canal, a blood-clot, a piece of placenta, or a shred of membranes in her uterus, are most favorable elements for the development of the microbes, but these must come from the outside in order to cause putrefaction and infection. If no germs entered the system of the women, no woman would be taken sick, just as urine may be kept fresh indefinitely merely by keeping out the germs of the air.[3]

It has been proved that the vagina and cervix contain microbes which may cause disease when they get into the tissues. Consequently, a puerperal woman may be infected by microbes which were in her body before delivery; and in this sense we may admit autogenetic infection, but even then the microbes in question do not form part of the organism of the patient. They have got into her genitals from the outer world, and, while they did not do her any harm as long as she was protected by her vaginal and cervical epithelium, they may become dangerous when this is destroyed in many places, as it inevitably will be in childbirth.

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[1] Max Runge: *Die Krankheiten der Ersten Lebenstage*, Stuttgart, 1885, pp. 138–164.

[2] Credé: in *Archiv für Gynäk.*, 1884, vol. xxiii. p. 77.

[3] W. Watson Cheyne: *Antiseptic Surgery*, London, 1882, p. 36.

Fritsch divides infection into pathogenic and non-pathogenic, the latter being substituted for "the auto-infection" of previous authors. Since the patient, according to his own description,[1] may be taken as sick by the non-pathogenic as by the other variety, and even die, I fail to see the practical advantage of the distinction.

Often puerperal fever appeared in so-called epidemics. According to Barker,[2] more than two hundred such epidemics have been described since 1740. These epidemics ravaged especially lying-in hospitals, but were likewise found in cities and country districts. Since the introduction of antiseptic midwifery these epidemics have entirely disappeared from lying-in hospitals and have become rare outside of them—a fact which is easily understood from the standpoint of the infection theory. Since we have learned to disinfect ourselves, our instruments, and our patient, and protect her against contact with substances that might carry infectious material, she is rarely taken sick, and by isolating her we prevent her from infecting others. The utter senselessness of the word "epidemic" as applied to puerperal fever is tersely expressed by Fritsch in the words that we might as well speak of an epidemic of gunshot-wounds after a battle.[3]

ETIOLOGY.

While the views on the nature of "puerperal fever" and allied diseases, which we unite under the name of "puerperal infection," are hypothetic, varying, and of more theoretic than practical interest, the etiology considers the real sources of these diseases, which have been found by experience. The practitioner will be glad, I am sure, to exchange the airy domain of theories for the solid ground of facts, proven to be so by irrefutable evidence.

It is a fact independent of all theories that puerperal women are more liable to disease than mankind in any other state.

Predisposing Causes.—The foundation of this vulnerability is already laid during pregnancy. The blood undergoes changes in quantity and composition. There is a general plethoric condition, an increase in the amount of fluid circulating in the blood-vessels. It is more watery. The red blood-corpuscles diminish, while the colorless increase in number. There is less hæmoglobin, albumin, fat, phosphorus, and iron than in the non-pregnant condition, and, on the other hand, a considerable increase of fibrin. This general plethora, this increase in leucocytes, and this surplus of fibrin can hardly fail to predispose to inflammatory diseases.

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[1] H. Fritsch: *Grundzüge der Pathologie und Therapie des Wochenbetts*, Stuttgart, 1884, p. 42.

[2] *Loc. cit.*, p. 439.

[3] *Loc. cit.*, p. 35.

The heart, especially the left ventricle, is hypertrophied. The walls of the blood-vessels become thicker, and at the same time their bore becomes larger. It is especially in the breasts and in the uterus that these vessels become much developed. The muscular tissue of the uterus grows to keep pace with the development of the fœtus. The lymphatics become so dilated that they may be mistaken for veins. On account of the slower movement of the nourishing fluids in these dilated blood-vessels and lymphatics, there is a predisposition to the formation of thrombi, which again may lead to inflammation or become a dangerous means of general infection.

The great irritability of the nervous system developed during pregnancy, and which appears as headache, toothache, neuralgia, vertigo, unnatural longings for some things, morbid aversion to others, and similar phenomena, constitutes likewise a predisposing cause. Shame in those who give birth to an illegitimate child, dread of destitution for themselves and their offspring in the very poor, are all unfavorable complications of childbirth.

After any labor the patient is exhausted in consequence of pain or loss of blood; and much more so if the labor has been tedious and unusually painful. No child is born without causing tears and abrasions, which may become infected. Abnormal deliveries, in which it becomes necessary to use instruments or introduce the hand into the uterus, are particularly predisposing factors.

Immediately after the birth of the child the uterine sinuses are closed by the formation of thrombi—a physiological process that either may be defective or be carried too far, causing dangerous or deadly hemorrhage or thrombosis in the veins of the pelvis or lower extremities.

A large amount of tissue has to undergo fatty degeneration, be absorbed, and expelled. While, before the birth of the child, there was a strong current in the direction of the uterus, after its expulsion the current goes inward. The superfluous material must be liquefied and carried to the natural emunctories. At the same time, the breasts enter upon a new and important function.

The lochial discharge contains débris from the parturient canal, and may become a propitious element for the development of micro-organisms, some of which are even found normally in the vagina and the cervix.

Primiparæ are even more exposed than those who have borne children before, because the labor takes longer time and the resistance of the soft parts is greater.

To crowd many puerperal women together augments the danger for each of them. If one of them is attacked by puerperal infection, the danger of the poison being carried to others is the greater the nearer the patients lie to one another. Cleanliness becomes more difficult, and thus the mass of putrefying substances found in the ward increases, and with it the danger of infection of the patients.

The *special cause* of puerperal infection is a poison which seems to be produced by certain microbes. That the severe cases, those which by a general term may be called puerperal septicæmia, are due to sepsis, is proved by the fact that by antiseptic measures we succeed in preventing the disease, and that if it has made its appearance they have great power of conquering it. Another proof is that microbes have been found in such numbers and under such conditions that they must be regarded as intimately connected with the disease; but this point properly belongs to the domain of the bacteriologist.

We have seen above (p. 292) why the milder forms of inflammatory puerperal diseases are supposed to have a similar origin.

Sources of the Poison.—Independently of the question of the rôle played by micro-organisms, experience has more or less definitely made known the sources from which the poison comes, and which consequently have to be guarded against. Such sources are patients affected with the same disease, suppurating or decaying tissues, putrefying substances within or without the body, and perhaps zymotic diseases.

An enormous stride toward the protection of childbearing women was taken when it became known that puerperal infection is a contagious disease. The merit of the discovery belongs to British authors. In this country it was brought before the profession in a masterly way by Dr. Oliver Wendell Holmes of Boston, Mass.[1] Nowadays it is admitted by everybody that the disease may be brought from one person to another. The only difference is, that some authors (Schroeder) rather call it a transmissible disease, thinking that the puerperal septicæmia is not contagious in the sense in which we apply the word; *e. g.* to smallpox. A healthy person entering a room in which lies a patient affected with smallpox may contract the disease without touching the patient. Most German authors deny that any such transmission through the air takes place in puerperal infection, and think that the disease is exclusively produced by septic material being manually or in a similar direct way deposited in the genital canal, and entering the wounds found there. We will presently come back to this point.

Sometimes patients who have been infected by being examined in one hospital have left it for another and caused other women to be infected from them in the new locality, probably through the instrumentality of vaginal examinations.

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[1] In April, 1843, Dr. Holmes published a paper on the "Contagiousness of Puerperal Fever" in the *New England Quarterly Journal of Medicine and Surgery*, and reprinted it with an extensive introduction as a pamphlet in Boston, 1855, under the title *Puerperal Fever as a Private Pestilence.*

That the puerperal infection may arise from suppuration was already pointed out by Semmelweis in 1847.[1] A pregnant woman with cancer of the uterus was examined by the students, and became the cause of fourteen puerperal women being infected and losing their lives. In this country we have the celebrated case of Dr. Rutter of Philadelphia, who in the year 1843 had forty-five cases of puerperal septicæmia in his own practice, while none of his neighbor's patients were attacked. In vain he bathed, changed his clothes, shaved off his hair, wore a wig, and stayed ten days away from the city. He did not take anything with him to his next patient that he had ever worn or carried, and she had an easy parturition. Still, she died of childbed fever. At the time no explanation was found of such a fearful mortality following in the track of one obstetrician. Meigs taught his students to see a dispensation of God's providence in it.[2] Later the mystery has been solved by the statement made by the well-known reviewer R. P. H., on the authority of an obstetrician contemporary of Dr. Rutter, that he was subject to an obstinate muco-purulent coryza, from which septic matter found its way to his hands.[3]

A French physician had delivered eight hundred women without the least accident, when he was seized with a suppurating adenitis, for which he carried a drainage-tube. Within three weeks he had three cases of puerperal septicæmia.[4]

In the Maternity Hospital we recently had a paralytic patient who had a large carbuncle on the sacral region. Two other puerperæ lay in the same ward and were treated by the same nurse. One of them, who had been perfectly well during the first eight days of her puerperium, got a chill, followed by a rapid rise of temperature up to 105.6° Fahr. On the cervix was found beginning diphtheritic infiltration. This was cauterized, the uterus washed out with creolin, 2 per cent., a suppository with iodoform inserted, and the patient was given quinine and brandy. She recovered in a few days. She had, of course, been removed immediately from the ward when taken sick. So was the other woman, who remained well. The carbuncle case was removed to Charity Hospital, the nurses put to other work, and the ward disinfected. By these prompt measures further trouble was avoided. The carbuncle patient had no puerperal disease.

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[1] Semmelweis: in *Wiener Zeitschrift*, Dec., 1847; *Schmidt's Jahrbücher*, 1848, vol. lviii. p. 196.

[2] Chas. D. Meigs: *Woman, her Diseases and Remedies*, 2d ed., Philadelphia, 1851, p. 608.

[3] *Amer. Journ. Med. Sciences*, April, 1875, p. 474.

[4] Sirédey: *Les Maladies puerpérales*, Paris, 1884, p. 99.

These are only a few instances among many showing that puerperal infection in its most serious aspect may be due to a poison formed in suppurating tissues.

Semmelweis also showed that the disease in the great lying-in hospital of Vienna was due to infection with poison brought on the hands of students going from the dissecting-room to the lying-in ward, and being allowed to examine the parturient women. The enormous mortality among the puerperal women dwindled down to a comparatively small figure when the students were compelled to anoint their hands before touching the dead bodies, and to disinfect them with chlorinated lime before examining the parturient women. From the foundation of the hospital in 1784 until the year 1823 the mortality was small: there had been twenty-five years in which it did not even reach 1 per cent., and a mortality of 4 per cent. had only occurred once during the whole period of forty years. This was before the study of pathology, that for a long period surrounded the Vienna school with unequalled lustre, had been inaugurated by Rokitansky. From that time until 1847 the mortality increased very much, and reached even 12 per cent.[1] In 1840 the hospital was divided into two services. In the first students were instructed; in the second, midwives. On alternate days the patients were sent to each of the two divisions, so that there was not the least difference in the nature of the cases on both sides. Nevertheless, the service in which the students were instructed had during the years 1841–46, 20,042 patients with 1989 deaths, a mortality of 9.92 per cent., whereas the second service, in which midwives were instructed, who did not dissect or make autopsies, had 17,791 deliveries with only 691 deaths, or 3.38 per cent.[2] Toward the middle of 1847, Semmelweis introduced chlorine as a disinfectant, and the result was a remarkable fall in the mortality, as shown by the following table, viz.:

Year.	Confinements.	Deaths.	Per cent.
1846	4010	459	11.4
1847	3490	176	5.0
1848	3556	45	1.27[3]

A similar case is reported from private practice. During a so-called epidemic of puerperal fever the Scotch physician Renton practised in the same locality as another doctor; all the patients delivered by the first remained healthy; all the sickness was on his neighbor's hand. As they were friends, the latter abstained himself from obstetrical practice and addressed all his cases to Renton. Not one was taken sick. The only difference between the two was that Renton did not make autopsies, and his friend did.[1]

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[1] Semmelweis: *Die Aetiologie, der Begriff und die Prophylaxis des Kindbettfiebers*, Wien, 1861, pp. 61–63.

[2] Semmelweis: *loc. cit.*, p. 3.

[3] Semmelweis: *loc. cit.*, pp. 56, 61.

The infection may as well come from tissue undergoing local death in the shape of gangrene.

Frequently pieces of placenta or membranes left behind in the uterus become the starting-point of puerperal infection. I saw once a curious case in which a rotten placenta did not infect its owner, but caused the most severe puerperal diphtheria in another woman. Two women were delivered at the same time, in the same room of the Maternity Hospital, by two different members of the house staff. The first was delivered of a macerated fœtus, and a stinking placenta was manually removed. The uterus was washed out with bichloride of mercury, and she did well. The second had her vagina partitioned by a thick fibrous band that prevented the descent of the child and had to be severed. When the doctor who had attended the first woman was through, he was allowed by him who had the other to examine this latter. That was after we had introduced the strict antiseptic treatment, but most likely he did not take the special care necessary to clean his nails after having dug in such dangerous tissue as a putrid placenta. So much is sure: the second patient had a narrow escape from death. At the time this occurred there had not been a case of puerperal infection in the hospital for six months.

Some years before I was connected with the Maternity Hospital a new building was erected for the lying-in women. It had scarcely been opened before such a violent so-called epidemic of puerperal fever broke out that the building had to be evacuated, and has never been used since. One of the surgeons connected with the hospital at the time has told me that in his opinion this outbreak was due to guano with which the contiguous grounds had been covered in order to surround the new hospital with a garden.

Some years ago there was an epidemic of puerperal fever in the New York Infant Asylum, the cause of which was found to be a dead rat undergoing decomposition in the cellar.

On the same ground, the immediate neighborhood of a churchyard, a dunghill, a privy, a stable, a cesspool, a sewer, a pool of dirty stagnating water must be looked upon as dangerous for a lying-in woman. Fehling observed an epidemic of puerperal fever, diphtheria, and erysipelas which was caused by the bursting of a waste-pipe. The dirty water had found its way into the ground upon which the hospital was erected. As soon as the evil was remedied the epidemic stopped.[2]

The relation between puerperal infection and zymotic diseases is not quite settled. Since diphtheritic inflammation is one of the most common forms of puerperal infection, there can hardly be any doubt that the poison may be brought from a person affected with diphtheria or diphtheritic wounds.

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[1] Sirédey: *loc. cit.*, p. 98.

[2] Fehling: *Archiv für Gynäk.*, 1888, vol. xxxii. p. 433.

Typhoid fever is so well characterized by its peculiar intestinal ulcers, and is so different from puerperal infection, that they certainly are different diseases; but that does not prevent one from leading to the other.

Scarlet fever may attack a puerperal woman, but it remains scarlet fever, following the same course as in any other patient.

Erysipelas is likewise sometimes seen as a complication of the puerperal state. Since my occlusion dressing is used it has become exceedingly rare in the Maternity Hospital. Lusk[1] and Matthews Duncan[2] have proved by statistics that there is no constant relation between the appearance of the two diseases. Fehleisen succeded in isolating and cultivating the bacillus of erysipelas, by which it was proved that it was a distinct disease, entirely different from any other. I recently saw it appear on the face of a pregnant woman, and the confinement take place during the attack, without the slightest complication. If erysipelas sometimes occurs in a woman suffering from puerperal infection, it certainly happens rarely, and not oftener than that disease attacks any other person who has open wounds. Gusserow injected Fehleisen's bacilli into the skin of two rabbits and produced erysipelas, but of six in which he injected the bacilli into the peritoneal cavity or in the subserous connective tissue not one was taken sick.[3] All this goes far to show that erysipelas and puerperal infection are two different diseases, and that one does not lead to the other. Still, many think puerperal infection may be contracted from a patient affected with erysipelas. It is chiefly from English authors that the assertion has come that erysipelas may produce puerperal fever; but English physicians have often included diffuse cellulitis under the term erysipelas, and that a suppurating cellulitis can cause puerperal infection is a generally accepted doctrine.

Ways by which the Poison Enters.—In the overwhelming majority of cases the infection takes place through wounds of the genital tract. Most modern authors admit even only this entrance. In my opinion this is too exclusive. There is a highly interesting illustrative case on record which, being old, is easily overlooked.

Depaul, in the discussion on puerperal fever in the French Academy, reported the case of a pupil midwife who took care of a woman with severe puerperal fever. While she was washing the genitals she felt an unpleasant sensation. In the evening she was taken sick, and died on the third day "with all the symptoms of the most characteristic puerperal fever." The post-mortem confirmed the diagnosis, and she was furthermore found to be a virgin and not in a menstrual period.[1] Sceptics will of course say that she had a small wound on her hands which became infected, but if so the disease would in all likelihood have begun as lymphangitis of the arm, of which there is no trace in the report. It is therefore only fair to admit that the infection in this case took place through the mucous membrane of the lungs.

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[1] W. T. Lusk: "On the Nature, Origin, and Prevention of Puerperal Fever," extract from *Trans. International Med. Congress*, Philadelphia, 1876, p. 24.

[2] M. Duncan: "On the Alleged Occasional Epidemic Prevalence of Puerperal Pyæmia or Puerperal Fever and Erysipelas," in *Edinburgh Med. Journ.*, March, 1876.

[3] Gusserow: in *Archiv für Gynäkol.*, 1885, vol. xxv. p. 179.

How the Poison is Carried to the Patient.—The common way in which the poison reaches the patient is through doctors, midwives, or nurses, who during examinations and manipulations deposit it in the genital canal. It may cling to a finger, an instrument, a lubricant, a sponge, a rag, or any other substance brought into contact with the genitals.

The examining finger may even carry the microbes found in the vagina and the cervix into the uterus, and cause infection. That is why an examination ought never to be undertaken before the vagina has been thoroughly disinfected; why we ought never to introduce the finger beyond the os externum if it can be avoided; and why a disinfectant intra-uterine douche should always follow when the uterus has been entered.

Many modern authors deny absolutely that the puerperal poison can be carried through the air. This is a view I cannot share. We have the historic proof that in many hospitals the mortality decreased considerably by the mere introduction of a better system of ventilation. Before we had our present antiseptic treatment in Maternity Hospital, and when the morbidity and mortality were at their worst, we always found that the patients placed in a ward that had just been fumigated with sulphur were free from fever for a week. The belief that the air can infect puerperæ has received its scientific basis in the observation that staphylococci and streptococci have been found floating in the air of the wards of hospitals. Sirédey[2] has reported a striking clinical case in point. A man suffering for six months from a stercoral abscess was nursed by his two nieces. Both were pregnant, both had very easy deliveries with an interval of two months, and still both were attacked by severe puerperal infection; and the child of the first had a few days after its birth a whitlow, a large abscess in the buttocks, and erysipelas all over the body.

While I therefore believe that the air can be the carrier of the puerperal poison, I wish not to be understood as if I meant that the whole atmosphere of a place could be contaminated. This is an old view exploded by the fact that in the same city one lying-in hospital or one district was the seat of a so-called epidemic, while another hospital or another district in the immediate neighborhood went scot-free. It is likewise disproved by the occurrence of many cases of puerperal infection in the practice of one physician, while another physician practising in the same locality had none—cases we have referred to above. It is only the air in buildings or in the neighborhood of a source of infection, such as a carrion, a sewer, a privy, etc., that can become the carrier of the poison.

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[1] Depaul: in *De la Fièvre puerpérale*, communications à l'Académie Impériale de Médecine, Paris, 1858, p. 31.

[2] *Loc. cit.*, p. 112.

Time of Infection.—The most common time for infection to take place is during the examinations and manipulations of delivery. But it may occur both before and after. Before delivery it may be brought on by examining the vagina without antiseptic precautions; nay, it may even arise in spite of the most scrupulous disinfection of the physician's finger if pathogenic microbes are carried from the vagina, where they are found normally, into the cavity of the uterus.

The late infections may be due to direct contagion, the nurse bringing the poison from one patient to the other; or germs carried by the air may enter the genital canal; or some of the microbes which were in the vagina before may multiply in the lochial discharge, and find their way into the interior of the tissues.

PATHOLOGY.

One of the characteristics of puerperal infection which has given rise to many misunderstandings is the great diversity of the pathological changes caused by the disease. This holds good even if we only think of those severe cases commonly called "puerperal fever," and applies, consequently, still more to our general term, puerperal infection. When, therefore, we now will try to point out these changes, it must be understood that they by no means are all present at once. By beginning with the external genitals and following the disease from organ to organ in a certain order, I hope to be able to give some idea of these manifold pathological conditions; and the reader will bear in mind that in different cases a smaller or greater number of organs are affected, and that the lesions may be of a milder or severer type.

VULVITIS AND VAGINITIS.—Catarrhal inflammation of the vulva and the vagina are characterized by redness, tenderness, and a mucopurulent discharge which becomes blended with the lochia.

The abrasions and tears which constantly are found in the external genitals frequently give rise to ulceration or become the seat of diphtheritic infiltration. This is in most cases of a light pearl-gray color, more exceptionally milk-white or sulphur-colored. It makes its first appearance as discrete spots not larger than a millet-seed, but soon these extend in all directions and melt together, so as to form one or more large, thick patches, firmly adherent to, imbedded in, and, as it were, dovetailed with, the subjacent or surrounding tissue. The patches have commonly round contours, measure from one-eighth of an inch to one inch in diameter, and about one-eighth of an inch in thickness. Like diphtheria of the air-passages, this infiltration has a predilection for the places where the canal becomes narrower—namely, the entrance of the vagina[1] and the cervix. Probably this is due to the predominant frequency of vulnerations at these narrower straits. The posterior commissure of the vulva and the posterior wall of the vagina are much more liable to be attacked than the corresponding anterior parts, and on the posterior vaginal wall, again, that part which lies below the cervix is most frequently affected. The explanation of this is probably to be sought in the fact that these parts are more thoroughly bathed with the fluid coming from the uterus, which stagnates there, becomes mixed with germs suspended in the air or already located in the vagina, and undergoes decomposition.

All torn and abraded surfaces fall more easily a prey to this diphtheritic infiltration. But I have also seen it on apparently healthy parts of the mucous membrane, yet covered with epidermis and separated by intervening tissue from all tears and abrasions. Sometimes the inside of the labia majora is alone affected.

The parts surrounding the patches are more or less swollen, often the seat of considerable œdema, dark-red, brown, or dirty greenish.

An ulceration in the upper part of the vagina may give rise to an abscess pointing in the perineum (Winckel).[2] More or less destruction may be caused by gangrene.

ENDOMETRITIS.—The endometrium is normally not thrown off altogether when the ovum is expelled. The separation takes place between the superficial and the deeper layer, and regeneration takes place from the latter as a starting-point. The endometrium may be the seat of a catarrhal inflammation. Then it is red, swollen, and covered with a puriform fluid. Sometimes it is studded with small round prominences of the size of a pin's head which contain a purulent fluid. At the same time the lips of the os and the cervix are swollen and covered with granulations that easily bleed.

The other affections of the endometrium soon spread to the deeper parts of the wall, and we describe them, therefore, under the next heading.

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[1] It is a very common mistake to confound the entrance of the vulva, *rima pudendi*, with that of the vagina, *introitus vaginæ*. The vulva is as distinct from the vagina as is the uterus; as to development, even much more so. The vulvar orifice is situated on the surface of the body, forms a straight line running in an antero-posterior direction, and is bounded by the labia majora. The vaginal orifice, on the other hand, is situated at the bottom of the vulva, from one to two inches below the surface, is circular, surrounded by a striped muscle, the constrictor vaginæ, and is more or less completely bounded by the hymen or its remnants, the *carunculæ myrtiformes*.

[2] *Loc. cit.*, p. 150.

METRITIS.—Four forms of metritis may be distinguished—the simple, the diphtheritic, the dissecting, and the putrescent. In them all the uterus is very much enlarged, sometimes reaching nearly up to the umbilicus a week or two after delivery. The cervix may be more or less torn, bruised, jagged, of a dirty-red, dark-brown, or greenish color. In bad cases large portions of it become gangrenous. The walls of the body are commonly very thick, ranging from one to two inches. The tissue is soft, friable, pulpy, near the inner surface almost diffluent, dark cherry-colored, and bathed in a thick, dirty-greenish fluid.

In the *diphtheritic* form small gray spots appear on the mucous membrane of the cervix, just as we have described the process in the vulva and the vagina. They may coalesce and form thick patches. In other cases only a fine gray film is found, like the bloom on a fruit. In the interior of the body similar formations may be found, especially at the entrance of the tubes. From here a yellow layer of diphtheritic infiltration may be followed out to the peritoneal covering of the womb.

Of *dissecting* metritis I have treated 8 cases, 6 of which I have described.[1] Besides, I have seen a specimen from the practice of another physician, and the Russian physician Süromiatnikow[2] has described 2.

The characteristic feature of this form is that a large piece of the muscular tissue of the uterus is entirely severed from its connection with the rest, and eventually expelled from the body. In the first case that came under my observation the patient died, and at the autopsy the loose body was found lying in the cavity of the womb. It was four inches long, two wide, and one thick. The walls were in some places as thin as tissue-paper, and even perforated by openings leading into the intestines. In the other cases similar bodies were expelled between the seventeenth and the forty-seventh day after delivery. The outside of these bodies has a grayish color; the cut surface is pink. Externally are seen round openings leading to canals filled with thrombi. Microscopical examination shows that these pieces consist of smooth muscle-fibres in a more or less advanced stage of degeneration. The amount of connective tissue between the bundles is considerably increased, and it contains numerous round cells. The thrombi are in the process of organization, being composed of a network of fibrin with interspersed round cells. Numerous veins and capillaries are seen filled with blood.

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[1] Garrigues: "Dissecting Metritis," *New York Medical Journal*, 1882, vol. xxxvi. p. 587; *Archives of Medicine*, April, 1883.

[2] *Centralblatt für Gynäk.*, 1881, vol. v. p. 276.

Since the introduction of strict antisepsis I have not had another case of the kind.

By the description of the macroscopical appearance and microscopical composition of these bodies it will be seen that they differ entirely from the condition described under the name of "putrescence of the uterus." This was also shown by the quality of the lochia, which sometimes were merely purulent, and not fetid at all. Nay, some of the patients did not even show any sign of being seriously ill.

Some cases of metritis offer the most horrid aspect. Of the many names under which this form has been described, that of "putrescence of the uterus" seems to be the most appropriate. The uterus is large, the walls thin, the external surface shows impressions of the intestines. The mucous membrane is changed to a brown or black, jagged, stinking slough, which hangs down in shreds or is movable on the subjacent tissue. The submucous connective tissue may be changed to a whitish mass, and the muscular tissue be dirty red, soft, and flabby. At other times the destruction goes deep into the latter, forming irregular cavities filled with a chocolate-colored or black pulp or a more ichorous or purulent fluid. The site of the placenta is particularly affected by this deep burrowing.

It may be that what I have described as dissecting metritis by less good treatment would have resulted in the putrescent form, but as it is it differs certainly in so pronounced a way from the description given of the putrescence of the uterus that it deserves a particular place in the description of the puerperal inflammation of the womb. According to my own observation, I think it is more likely that it is connected with the diphtheritic form, as in several of the cases of dissecting metritis there had been diphtheritic infiltration and patches, and as in one case an infiltration of this kind formed a layer extending from the inner surface nearly through the whole thickness of the wall, and circumscribing a large piece of comparatively healthy tissue, which if the patient had survived might easily have formed such a loose body as that found in the other cases.

SALPINGITIS.—The puerperal inflammation of the Fallopian tubes is always combined with endometritis, and is probably due to extension from the uterus. It is mostly a superficial-catarrhal-affection, characterized by the usual signs—redness, swelling, the partial loss of the epithelium—and the tube is filled with a purulent fluid. The mucous membrane may be the seat of diphtheritic infiltration, and the fluid become ichorous.

OÖPHORITIS.—The inflammation of the ovaries is a very common occurrence in the puerperal infection. There may be perioöphoritis—

that is, inflammation of the surface, with formation of pseudo-membranes. This is always combined with peritonitis. Parenchymatous oöphoritis is the inflammation of the inner substance. The ovary is swollen and saturated with a bloody fluid; often small hemorrhagic foci and streaks are found; the so-called albuginea[1] is apt to tear and let the stroma form round prominences on the surface: an abscess may form, or the whole interior become transformed to a thin sanious fluid.

CELLULITIS AND ADENITIS.—Any part of the subperitoneal connective tissue around the womb, at the base of the broad ligaments, between their folds, in the iliac fossa, the anterior and posterior abdominal wall, and the recto-ischiatic fossa may be inflamed. It becomes swollen, œdematous, infiltrated with a turbid serous fluid, and is often the seat of hemorrhagic thrombosis. This condition may end in resolution or in suppuration. If the abscess is found in the lower part of the abdominal wall, the pus may extend up to the umbilicus, make its way to the skin, and perforate it. An abscess of the iliac fossa points at the groin a little inside of the anterior superior spine of the ilium. An abscess formed in the anterior part of the small pelvis (by some authors called the obturator fossa) opens likewise at the groin, but inside of the femoral vessels, above the Fallopian ligament. A collection between the folds of the broad ligaments follows the ilio-psoas muscle downward, and may open below the Fallopian ligament. From the iliac fossa the abscess may extend upward and backward, and perforate the abdominal wall at the top of the crest of the ilium, where a small triangular space is left between the latissimus dorsi and external oblique muscles ("J. L. Petit's triangle" of French authors); or it may reach the lower surface of the diaphragm and form a fistula in the lumbar region. In rare cases the pus may follow the nerves out of the pelvis through the greater sacro-sciatic or the obturator foramen.

More frequently, than to wander in this way to some distant point and perforate the skin, the abscess opens into one of the hollow organs in its neighborhood—the vagina, the intestine, or the bladder.

The lymphatic glands in the pelvis are often swollen or suppurate.

LYMPHANGITIS.—The lymphatic vessels play a very important rôle in the propagation of puerperal infection. From the vulva and the lower fourth of the vagina the inflammation goes to the superficial inguinal glands, and may extend through the saphenous opening to the deep inguinal glands, or along the deep blood-vessels into the abdomen to the lymphatic glands which are situated on the external iliac artery. In this way a neglected ulcer on the labium majus may give rise to a peritonitis.

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[1] Under the epithelium of the ovary are found three layers of fibrous tissue: the most superficial and the deepest ones have longitudinal fibres, the middle one transverse fibres. This is what is called albuginea, but it is intimately connected with the deeper tissue, and cannot be separated from it with the knife (Waldeyer: *Eierstock und Ei*, Leipzig, 1870, p. 13).

From the upper three-fourths of the vagina and the cervix the lymphatics open into the internal iliac and sacral glands. Those of the uterus begin in the mucous membrane as spaces lined with endothelium. In the muscular layer are found similar spaces and vessels. They all communicate with a superficial layer of vessels in the serous covering. From the uterus the lymphatics go through the broad ligaments and reach the lumbar glands. In the normal condition the lymphatics are not visible unless made so by injection. In lymphangitis they become as thick as a goose-feather, and form prominences on the surface of the uterus which contain a puriform fluid and may be as large as a cherry.

It will be seen that the lymphatics form an easy road for puerperal infection from nearly the whole vagina and uterus to the peritoneum.

PERITONITIS.—This is the most common feature of the graver cases of puerperal infection. It may be local or general. In the first case it is limited to the pelvic organs, and even when generalized the affection is most pronounced here. As a rule, it starts from the uterus. The local form may be adhesive or purulent. The peritoneum is injected, partially covered with false membranes; the intestines are bound together, and often to the uterus, by a fibrinous exudation. A free serous or purulent fluid is found in the peritoneal cavity: often it has a milky color, which gave rise to the theory of the disease being a metastasis of the milk. Large solid masses, much like curdled milk, are found in it. The intestines are distended with gas, and lift the anterior abdominal wall up, so as to form a uniform convex swelling.

PLEURISY AND PERICARDITIS.—From the peritoneum the inflammation sometimes extends to the pleura and the pericardium, an easy passage being offered the microbes through the stomata of the diaphragm, openings leading from the peritoneal cavity into the lymphatics. The pathological changes are the usual ones—swelling, imbibition, injection, formation of false membranes, and more or less sero-purulent fluid.

PHLEBITIS.—The inflammation of the veins is not so common as lymphangitis, and is often combined with the latter and peritonitis. Phlebitis is intimately connected with thrombosis. In most cases the latter precedes, but sometimes it may be secondary, the inflammation working its way in from the sheath of the vein and causing roughening of the endothelium, leading to the precipitation of the fibrin of the blood. We distinguish uterine phlebitis and phlebitis of the lower extremity.

1. *Uterine Phlebitis.*—The uterine sinuses are normally closed by thrombi near the inner surface, but abnormally the thrombosis may extend not only through the whole thickness of the uterine wall, but

follow the uterine and the internal iliac veins or the ovarian veins to the vena cava inferior. The formation of a thrombus may also be due to compression interfering with the free reflux of the venous blood, or to the slow movement of the blood in consequence of the dilatation of the vessels mentioned above.

A thrombus may again become canalized, or it may be organized to a solid plug of connective tissue, permanently closing the vein. Abscesses may form in the uterine wall in contact with the inflamed vessel. A piece of the thrombus may be torn off and carried away by the current of the blood, causing the usual phenomena of embolism. The thrombus may melt in the centre, forming pus or a sanious fluid. This may break through into the blood-current, causing similar processes to take place in nearly all the organs of the body.

Most frequently the *lungs* are affected. Wedge-shaped infarctions are formed with the base turned to the pleura and the apex in the direction of the root of the lung. Here the tissue is hardened, friable, dark brown, and gives rise to lobular pneumonia. Soon grayish spots appear in it, which coalesce and form an abscess. Besides, there may be found hypostatic pneumonia in the posterior part of the lungs. The mucous membrane of the bronchi is commonly swollen and injected.

The *spleen* is much enlarged, soft, and the seat of similar infarctions as the lungs, but they rarely form abscesses.

The *kidneys* are hyperæmic, and often the seat of infarctions and metastatic abscesses. After protracted suppurations they may become a prey to amyloid degeneration. Sometimes the abundant cellular tissue in which the kidney is imbedded is the seat of inflammation.

The *liver* is large, soft, friable, its cells enlarged, cloudy, and full of fat-globules. Metastatic abscesses are formed.

The mucous membrane of the *intestine* is usually œdematous, the follicles and the lymphatic glands swollen. No ulcers are found.

The *heart* may be affected by endocarditis, which mostly becomes ulcerous. The principal seat is the mitral valve, especially its lower surface. The leaflets of the valve become thickened, and sometimes vegetations are found on their borders. Miliary abscesses are formed in the deeper layer of the endocardium. The muscular part of the heart may harbor large abscesses (myocarditis). The pericardium may be thickened, injected, covered with false membranes, and its cavity contain sero-fibrinous or purulent fluid (pericarditis).

OPHTHALMIA.—Both eyes may be destroyed. The process begins as conjunctivitis, but soon pus forms between the choroidea and the retina, and ruptures through the vitreous body and the cornea.

Meningitis, phlebitis, and thrombosis of the veins of the *brain* are rare occurrences.

Inflammation and metastatic abscesses are likewise found in the *breast*, the *parotids*, the *tonsils*, and the *thyroid body*.

On the *skin* appear erythematous, erysipelatous eruptions, and miliary vesicles or large pustules filled with pus.

ARTHRITIS.—The joints, especially those of the shoulder, elbow, wrist, knee, hip, pelvis, and between the sternum and collar-bone, are often inflamed. Articulations may be swollen, their synovial membrane injected; a purulent fluid may fill their interior and break through to the surface. Ligaments, cartilages, and bones may be implicated, and a permanent ankylosis may be the final result.

In the *subcutaneous and intermuscular tissue* may be found large abscesses and masses of mortified tissue.

2. *Phlebitis of the Lower Extremity.*—The disease called phlegmasia alba dolens is in most cases combined with phlebitis. Sometimes a thrombosis of a vein is the original lesion, to which may be added periphlebitis and diffuse cellulitis of the lower extremity. In other cases the inflammation of the connective tissue is the first lesion, with which later may or may not be combined thrombosis and phlebitis.

In the first class the thrombosis of the veins of the leg may be a primary lesion, and already begin during pregnancy, or it may be secondary, a sequel to a similar condition in the internal and external iliac or the ovarian veins. The thrombus may be resolved or organized to a solid plug of connective tissue, or it may give rise to periphlebitis and diffuse cellulitis of the extremity, or it may soften, suppurate, and produce all the same metastatic processes just described for the uterine variety.

The second form of phlegmasia alba dolens is a cellulitis starting from the abdominal wall, the genitals, the perineum, and the buttocks, and spreading over the lower extremity on one or both sides. The leg swells. The skin is pale or slightly pink, tense, and thickened. Large vesicles filled with serum may appear on it. Both the subcutaneous and the intermuscular connective tissues are affected. Thrombi may form in lymphatics and veins. But in other cases the inflammation does not go beyond the sheath of the vessels, and their interior remains intact. The inguinal glands swell. The connective tissue may suppurate and the abscesses perforate the skin, or mortification may set in. This pernicious form is fortunately very rare. Varicose veins predispose to the formation of thrombi.

ACUTEST SEPTICÆMIA.—In this form of puerperal infection we do not find very great pathological changes. The process is so rapid that the different inflammations heretofore described hardly find time to be developed before the patient succumbs. Still, there are traces of lymphangitis or phlebitis of the uterus, swelling of the connective tissue, a little bloody serous fluid in different cavities; the glandular organs of the abdomen are enlarged, soft, friable, their cells in the condition called cloudy swelling; the blood is dark, thin, and little prone to coagulation.

SYMPTOMS, DIAGNOSIS, AND PROGNOSIS.

VULVITIS AND VAGINITIS.

SYMPTOMS.—The catarrhal inflammation causes smarting, especially after micturition. In the ulcerative form there are often swelling of the labia and a moderate rise in temperature. The lochial discharge is liable to become fetid. Sometimes the patient cannot pass her urine. The ulcers heal slowly; two or three weeks may be required.

The diphtheritic form is much more serious. The first symptom which shows a deviation from the normal course of the lying-in period is the fever, which mostly occurs in from two to four days after delivery, more exceptionally on the same day or as late as six or seven days after. Sometimes it is ushered in by a decided chill or by a chilly sensation. The temperature may at once rise to 103° or 104° Fahr., but commonly it is lower and rises gradually. The highest temperatures in my hospital cases ranged from 100.6° to 107°, and in the majority it was between 102° and 104°. The temperature has no typical curve, except that, as a rule, it is higher in the evening than in the morning.

The pulse is accelerated. The highest frequency in our cases ranged from 88 to 160 beats per minute; in the majority it was between 112 and 120. It has a great tendency to become weak.

The respiration, likewise, is accelerated. The highest rate per minute ranged from 28 to 58; in the large majority it varied between 28 and 32.

The patient has no appetite. The tongue is coated. Often there are vomiting and diarrhœa. Generally she complains of pain in the hypogastric region or in one or both groins, sometimes extending down to the legs.

As a rule, the uterus is implicated, and we find it large and tender. This tenderness may spread more or less over the abdomen, and very often it is found in the groins, where likewise some swelling may be observable. The abdomen may become tympanitic. Sometimes peritonitis develops.

The lochial discharge is mostly scant, dirty-grayish, and offensive, but if the process does not extend to the uterus it may be normal.

The secretion of milk in the more severe cases does not begin, or stops soon.

The nervous system may be considerably disturbed, as proved by the presence of severe headache, stupidity, or delirium.

Very commonly there are abnormalities in the secretion or evacuation of the urine. Sometimes the urine contains albumen, bladder epithelium, and young round cells. The amount is often diminished. Uræmic symptoms may develop. Micturition is often frequent and painful. There may be enuresis or retention.

The labia are often œdematous; erythema or erysipelas may start from the genitals and spread over large parts of the body.

In rare cases there are jaundice, sweet breath, and profuse perspiration.

The signs of a general disturbance of the system often precede the appearance of the diphtheritic infiltration for several days.

The patches appear from two to ten days after confinement, commonly from three to seven days. (For the description of these patches the reader is referred to the section on Pathology.) The disease, as a rule, spreads for several days, either by the extension of already affected places or by the appearance of new centres at a distance from the first ones. From the time infiltration ceases until the sloughs produced by the treatment are cast off and the sores healed, about a week elapses. When once the diphtheritic process has stopped the patient recovers rapidly.

More or less extensive destruction may take place if the tissues become gangrenous. This occurs especially in difficult instrumental deliveries if proper antiseptic precautions are neglected.

Where there has been considerable loss of substance the vagina may be more or less constricted by cicatrices. Once I had the opportunity of seeing a patient of this kind during a following pregnancy. The extensive cicatricial tissue softened, and did not cause any obstruction to the birth of the child.

As to DIAGNOSIS, I shall only mention that torn or abraded surfaces may be simply covered with a thin yellow layer of inspissated pus, which might be taken for diphtheritic infiltration, but which differs from it by being strictly limited to the surface of the wound, from which it can be wiped off, while diphtheritic infiltration begins in discrete spots, forms a thick membrane, penetrates the subjacent tissue, and may appear in apparently intact parts of the mucous membrane. Besides, these pus-covered surfaces do not give rise to fever or any other symptom, and heal without any treatment except the occlusion bandage to be described later.

The PROGNOSIS is good in the catarrhal and simple ulcerative form. In the diphtheritic it ought to be very guarded. Out of 27 of my patients, whose histories formed the base of a paper on puerperal diphtheria,[1] 5 died.

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[1] Garrigues: "Puerperal Diphtheria," in *Trans. Am. Gyn. Soc.*, 1885, vol. x. pp. 96–116.

ENDOMETRITIS AND METRITIS.

SYMPTOMS.—In the *simple* inflammation of the endometrium and the muscular tissue there are moderate fever, sometimes ushered in by a chilly sensation, some pain, especially severe after-pains, headache, anorexia, and a coated tongue. The lochia are fetid, and stay red longer than normal or become red again after having been yellow. There are subinvolution and some tenderness of the womb.

The *diphtheritic* inflammation has been described, together with that of the vulva and the vagina.

The *dissecting* metritis is only a pathological curiosity, and does not give rise to special symptoms, except a protracted purulent discharge.

The *putrescent* form is likewise mostly of anatomical interest. Still, it is characterized by symptoms similar to those of the worst diphtheritic cases, and by a particularly stinking, dark lochial discharge.

PROGNOSIS.—The prognosis of the simple endometritis and metritis is favorable. It lasts a week or two. In the diphtheritic form it is doubtful, as it often leads to the patient's death. The dissecting form seems to have a comparatively good prognosis. Of 11 cases known to me, only 1 ended fatally, and in this one death was accidental. The putrescent, on the contrary, is nearly absolutely fatal.

SALPINGITIS AND OÖPHORITIS.

The symptoms of these affections become blended with those of endometritis and peritonitis, which they accompany.

CELLULITIS (PARAMETRITIS) AND ADENITIS.

SYMPTOMS.—The inflammation of the cellular tissue is most frequently announced by a chill or chilly sensation, followed by a continuous fever, with the usual general symptoms of headache, anorexia, and weakness. The pulse and the respiration become more frequent. The patient complains of pain on one side of the uterus. By bimanual examination we find a swelling in one of the broad ligaments. The uterus is hardly movable. When the swelling increases in size it pushes the uterus over on the opposite side. In rarer cases both sides are affected. By pressing on the nerves passing through the pelvis the exudation may give rise to violent neuralgia in the lumbar region and the thigh. If the inflammation extends to the iliac fossa or begins there, the leg is drawn up and adducted, so that the knee rests on the thigh of the healthy side. The whole leg becomes more or less œdematous. Sometimes thrombi may be felt in the veins in Scarpa's triangle or at the popliteal space. The inguinal glands may swell.

In most cases the swelling of the connective tissue ends in resolution and the patient regains her health. In others suppuration sets in. This is marked by a repetition of the initial chill and a rise in the temperature. The swelling softens and gives the sensation of fluctuation. The pus may be evacuated through the intestine, the vagina, the bladder, the uterus, or extend, in the manner described above, along certain muscles and ligaments and perforate the skin in certain places. These migrations are often very slow, and the woman's strength is sorely tried. Often the process goes on even after perforation has taken place. Long fistulous tracks are formed, the fever continues, and the skin is again perforated in other points. If the pus is evacuated through one of the hollow organs, it is mixed with the urine, the stools, or the lochia. As a rule, the abscess is then soon closed. Exceptionally, fecal matter passes from the intestine into the abscess, and keeps up the inflammation indefinitely until a counter-opening is made and free drainage established.

DIAGNOSIS.—It is sometimes quite difficult to decide whether a pelvic exudation is intra- or extra-peritoneal. Cellulitis begins nearly always on one side, and is mostly limited to that. The intra-peritoneal effusion is not bound to any particular line of demarkation, and is found most frequently in Douglas' pouch. Later, the extra-peritoneal effusion goes farther away from the peritoneum, especially down the side of the vagina or to the upper part of the thigh, whereas a peritonitic exudation, if it spreads, extends over on the other side or upward. Cellulitis is nearly always connected with a tear in the vaginal portion.

PROGNOSIS.—As a rule, the prognosis is good. The swelling may disappear in a few days, but it may also last for many months without suppurating. If suppuration sets in, the danger is greater, but with proper treatment even then nearly all recover within a few weeks. The most favorable place where the abscess can open is in the vagina, and that is at the same time the most common. A rupture into the peritoneal cavity is exceedingly rare, and fatal if laparotomy is not performed at once. If cellulitis is found as part of a general infection of the whole system, the result as to life and time is very uncertain.

LYMPHANGITIS.

Lymphangitis may take its origin from the vulva or from the uterus.

1. *Vulvar Lymphangitis.*—Lymphangitis may start a day or two after confinement from a sore in the vulva and lower fourth of the vagina, and follow the lymphatics to the superficial inguinal glands. The common symptoms of fever, such as accelerated pulse, increased temperature, loss of appetite, general malaise, are present. The vulva smarts; the labia may swell; red streaks appear on the skin leading to the groin, where the superficial glands swell, but very rarely suppurate.

PROGNOSIS.—If the lymphangitis does not extend any farther, it is of small importance and lasts only a few days. But if the inflammation implicates the deeper inguinal glands and the one in the crural ring, it may enter the abdominal cavity and cause peritonitis.

2. *Uterine Lymphangitis.*—Lymphangitis of the uterus gives rise to pain in the lower part of the abdomen. The uterus is large and tender, especially at the horns. The usual fever symptoms are present. The pulse is accelerated and full. There may be a little vomiting and some tympanites.

DIAGNOSIS.—Uterine lymphangitis differs from local peritonitis by the absence of swelling in the vaginal vault—from general peritonitis by the absence of green vomit, the limitation of the swelling to that part of the abdomen situated below the umbilicus, and the volume of the pulse.

PROGNOSIS.—If the lymphangitis continues to be limited to the uterus, it is not dangerous, but it may spread and cause inflammation of the cellular tissue or of the peritoneum. Sometimes it gives rise to subinvolution of the uterus and the symptoms characteristic of chronic metritis.

PERITONITIS.

Local peritonitis must be distinguished from general peritonitis, both on account of the difference in degree of the symptoms and in the prognosis.

1. *Local Peritonitis,* like most other puerperal inflammations, is commonly ushered in by a chill, but this lasts from ten to twenty minutes or more, and is accompanied or followed by a peculiarly intense pain in the lower half of the abdomen. There is great tenderness even on slight pressure. The temperature rises suddenly to 103° or 104° Fahr. The pulse beats 100 to 120 in the minute, and is small and hard. The respiration is also accelerated. The fever is continuous, but shows an exacerbation toward evening. During the chill the face is pale, but with the reaction the cheeks become colored and the skin moist. Often perspiration is present. The patient has no appetite, but an unquenchable thirst. The tongue is coated. In the beginning there is constipation, later followed by diarrhœa. Sometimes there is vomiting of food, mucus, and bile. Moderate hiccough may trouble the patient. The lower half of the abdomen is distended.

The woman lies on her back, and draws up her knees in order to lessen the tension in the lower part of the abdomen.

The secretion of milk is sometimes normal, at other times diminished.

The lochia are scant, and often offensive and dirty. In the course of a week or two a distinct tumor is felt above the pubes and in the vagina. It comprises the uterus, the appendages, and part of the intestines, bound together by inflammatory exudation and false membranes. It is somewhat uneven; the different parts offer a different degree of resistance and a different tone on percussion. Sometimes a kind of crepitation, like that in a snowball, may be felt on pressure. It takes place probably in adhesions. In the vagina the tumor is most frequently felt in Douglas' pouch, pushing the uterus forward. It may also be found on one side, and tilt the fundus over to the other. Where it is found it presses the tissues below it downward. Thus the cervical portion is effaced, the cervix appears thicker, and no distinction can be made out between it and the body of the uterus. The uterus is kept immobile by the inflammatory products.

This swelling may end in resolution in the course of two or three weeks. Gradually the pain, tenderness, fever, swelling, etc. diminish and the patient is restored to health. It may also suppurate. Then there is an exacerbation of the fever, with one or more chills; the swelling softens, and distinct fluctuation or bogginess may be felt in some place. The pus may find an exit through the vagina, the bladder, or the intestine. If it tends to open into the vagina, distinct fluctuation can be felt here. The approach toward the bladder is marked by frequent micturition and dysuria. The advance toward the rectum is heralded by tenesmus. Wherever the abscess ruptures a considerable flow of offensive pus, mixed with grumous masses, is evacuated. If the opening is large enough and in a favorable locality, the abscess may be emptied at once, and soon close. But if the opening is too small for complete drainage, or situated above the bottom, or if the tumor is composed of different compartments, the process of evacuation may be very protracted. At times there are a cessation of the flow, an exacerbation of the fever, and an increase in the swelling until a new opening is formed. This may end the scene, or the process may go on indefinitely until the patient dies of exhaustion.

The pus may likewise follow the wall of the vagina and form a large abscess in the ischio-rectal fossa. The bladder and the intestine may also become inflamed. From the bladder the inflammation may work its way up through the ureters to the kidneys and produce pyelo-nephritis. Even pulmonary phthisis may be added to the other manifestations of disease.

PROGNOSIS.—The local peritonitis, as a rule, ends in recovery, but in some cases it may become a general peritonitis, which commonly soon ends the patient's life. Or it may take the protracted course just described, when the patient is exposed to death from exhaustion. Even the mild form, that ends in resolution, is in so far a serious disease as it is very apt to leave the patient in a condition of incomplete recovery. When once there has been peritonitis it is very liable to return. It may cause abnormalities of the internal generative organs which make the patient an invalid for life, it may interfere with ovulation and impregnation, and it may become a source of suffering in a new pregnancy.

2. *General Peritonitis* offers the same symptoms as local peritonitis, much intensified. It begins, as a rule, from two to four days after delivery, but may follow immediately after parturition. The rigor is very long, lasting from half an hour to several hours. The pain is exceedingly severe, and spreads rapidly all over the abdomen. The pulse is very frequent, 120 to 160 in the minute. The respiration is very much accelerated, 26 to 56 per minute, and shallow, both on account of the pain produced by the respiratory movements and on account of the compression of the lung caused by the tympanitis. The patient lies on her back with the knees drawn up, avoids every movement, and dreads every approach. Even the weight of the bedclothes may be intolerable. Her face expresses the greatest anxiety and pain. Her features are pinched; the angles of the mouth are drawn down; the eyes sink deep into the sockets, and have a dark streak under the lower lid. The skin is pale. The tongue is dry, red at the point and the edges, brown in the middle. The thirst is unquenchable. The woman vomits continuously, and the vomit soon gets a characteristic green color, which has been compared to hacked spinage. Commonly she has diarrhœa, and frequently hiccough.

The urine is scant or suppressed, must usually be drawn with a catheter, and contains often albumen.

The milk secretion soon ceases. The lochial discharge is scant, often fetid, or it stops altogether.

The abdomen is enormously distended by gas in the intestines. These at the same time push the diaphragm up to the fourth rib. The percussion sound at the top is tympanitic, at the sides dull or flat. The mind may stay clear to the last, but sometimes somnolence or delirium prevails. Insomnia is common.

PROGNOSIS.—General peritonitis is one of the most dangerous of puerperal diseases. Still, the patient may survive.

Favorable signs are the decrease in the frequency of the pulse and the respiration, the fall of the temperature, the disappearance of the abdominal pain, the subsidence of the distension, the cessation of the vomiting, return of cheerfulness, appetite, and strength.

Bad signs are a pulse above 140, a temperature above 104°, a laborious respiration over 40, severe diarrhœa, cold, clammy extremities, the appearance of large purple spots, profuse perspiration, a feeble, irregular pulse, the subsidence of the pain, while the distension of the abdomen increases.

Death occurs commonly at the end of nine or ten days, except in the acute cases caused by rupture of an abscess into the peritoneal cavity, when life is ended in a day or two.

If local peritonitis gives rise to invalidism and permanent pathological sequelæ, this applies, of course, still more to general peritonitis.

PLEURISY.

Most frequently pleurisy is added to a pre-existing peritonitis, but it may be found without the latter. Sometimes it is due to phlebitis and embolism.

If combined with other inflammations, it is not easy to diagnosticate. If added to peritonitis, the respiration becomes still more embarrassed and there is an exacerbation of the fever, perhaps a new chill. On account of the pain caused in disturbing the patient it is hardly feasible to make a thorough physical examination. If it is possible to do so, it elicits the usual signs of an exudation in the pleural cavity. The exudation is sero-purulent, similar to that in the peritoneal cavity. If due to infected emboli, it is always purulent. This form may appear quite insidiously, and is, as a rule, combined with similar affections of other organs.

PROGNOSIS.—Pleurisy is always a very serious complication of childbed.

PNEUMONIA.

Pneumonia is found in two forms—either as a hypostatic affection of the most dependent parts of the lungs or as multiple foci around infected emboli and infarctions. It is commonly combined with pleurisy. The inflammation of the lungs is characterized by pain in the chest, cough, fever, bloody expectoration, and dyspnœa; but these symptoms may be absent or masked by concomitant disorders. The condition can then only be diagnosticated by the stethoscopic signs characteristic of pneumonia outside of the puerperal state—crepitant râles, bronchial respiration, and a flat percussion sound.

The PROGNOSIS is grave.

PERICARDITIS.

Like pleurisy, the inflammation of the pericardium may either simply be propagated through the lymphatics from the peritoneal cavity, or it may be due to an invasion of emboli from a venous thrombus.

The SYMPTOMS become mostly merged in those due to the other affections present. Sometimes a friction sound may be heard or an increase in the dull area belonging to the heart.

PHLEGMASIA AL[illegible]

1. *Thrombo-Phlebitic Form.*—A thro[illegible] oral vein during pregnancy. It is accom[illegible] heavy feeling in the extremity. It is [illegible] first days after confinement. Generally [illegible] of the lying-in period. Sometimes it is [illegible] ances, anorexia, bad taste, a coated tongue [illegible] There may be a chill, and at all events [illegible] beginning. The urine is high colored. [illegible] primarily in the leg, this swells from the [illegible] or the swelling may extend over the adjoin[illegible] if it is consecutive to thrombosis of the pelv[illegible] lows the opposite course. The leg is pain[illegible] and tense; by means of palpation the affecte[illegible] hard, sensitive string; the epidermis may be ra[illegible] which burst; the skin may redden in some pa[illegible] by an abscess. The affection may pass over [illegible] through obstruction of the vena cava inferior. [illegible] independently.

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The phlegmasia commonly ends in resolutio[illegible] to six weeks. Suppuration may set in and the pa[illegible] Death may be caused by gangrene or septicæmia.

2. *Cellulitic Form.*—In the cellulitic form of [illegible] high fever, considerable pain, redness of the skin [illegible] suppuration of the subcutaneous and intermuscular [illegible] and considerable mortification. Large shreds of [illegible] tissue may be expelled and the sores heal, but there is [illegible] the patient succumbing to septicæmia or of her being [illegible] suppuration and gangrene.

VARICOSE PHLEBITIS.

Varicose veins are more disposed to the formation of [illegible] phlebitis than healthy veins. In the majority of cases [illegible] are of small importance—some pain, tenderness, and [illegible] If the deeper veins are affected, the skin acquires a [illegible] color, which has given rise to the name *phlegmasia [illegible]* opposed to the white variety. In some places hard nod[illegible] The vein becomes fastened to the neighboring tissues. As [illegible] condition ends in resolution, but a periphlebitic abscess may [illegible] open on the skin. Finally, the thrombus in this form, as [illegible] the preceding one, may become infected, soften, break down, [illegible] rise to all the phenomena accompanying uterine phlebitis.

The PROGNOSIS of varicose phlebitis is, therefore, upon the [illegible] good, but still it ought to be a little guarded.

UTERINE PHLEBITIS.

There may be a simple thrombosis of the uterine sinuses, which may extend to the other pelvic veins, but it can hardly be recognized until it reaches the iliac veins, when we get the swelling of the lower extremity which has been considered under the title "Phlegmasia alba dolens."

On the other hand, the uterine thrombus may become the seat of an infection of the worst kind, and give rise to infectious uterine phlebitis, one of the most serious puerperal diseases.

It begins with an intense and long chill, followed by other chills without any regularity. It is furthermore characterized by metastatic processes in one or more organs. The chills are probably caused by the invasion of the septic matter (micrococci or their chemical products) into the blood. In the beginning the fever is somewhat like an intermittent fever, but the more widely the metastases are distributed the more it assumes a continuous type. During the chills the temperature rises to 104° or 106°, the pulse beats 140 or 160, the respiration becomes as frequent as 36 or 56. In rare cases there are no distinct chills, but only a chilly sensation. In the intervals between the chills, especially during the first, the patient feels great relief; the temperature sinks to 100° or 101°; the pulse and the respiration become much less frequent. The patient has no pain; often there is even no tenderness. There is no tympanites.

But soon the aspect changes. The skin takes a yellowish tint, and sometimes there is pronounced jaundice. The nose looks pinched; the cheeks are hollow; the tongue is dry and coated. There is complete anorexia, but great thirst, insomnia, headache, sometimes diarrhœa, less frequently vomiting. The urine is scanty, and contains almost always albumen.

The organs first affected by the secondary infection are the lungs, then the pleura, the heart, the liver, the kidneys, the spleen, the intestines, the meninges, the brain, the eyes, the articulations, the skin, and the connective tissue.

We have spoken of pneumonia, pleurisy, and pericarditis above, and will soon make a few remarks on the other localizations.

DIAGNOSIS.—The repeated chills, with comparatively free intervals, give puerperal phlebitis some resemblance to malarial fever. But the chills in puerperal phlebitis do not come with the regular type of malarial fever, and the longer it lasts the more continuous becomes the fever. Sometimes the swollen veins may be felt in the pelvis. If a phlegmasia alba dolens is added, the nature of the disease is clear. Uterine phlebitis is often accompanied by repeated uterine hemorrhages. The appearance of the metastatic affections is entirely characteristic of phlebitis.

Puerperal phlebitis developing adynamic or ataxic symptoms may in some degree simulate typhoid fever. The first point to settle is that the patient has recently been confined. If this is concealed, it can easily be ascertained by the condition of the genitals, the abdominal wall, and the breasts. (See Vol. I. p. 526.) A puerpera may, of course, have typhoid fever, but this happens very rarely. In typhoid fever there is pain on pressure in the right iliac fossa; the stools have a peculiar yellow color; a few pink spots appear on the abdomen; the temperature is continuously high; visceral complications are rare; a decided change for better or worse takes place at the end of the third week. In puerperal phlebitis there may be gargouillement, but no pain on pressure in the right iliac fossa; the skin may show an eruption, but it is more extended and has the character of erysipelas, uniform erythema, large purplish patches, papules, or petechiæ. The temperature rises suddenly to a great height, and falls again several degrees, to rise again at irregular intervals. Every rise is, as a rule, accompanied by a severe chill. Complications in different organs are a chief feature. The disease has not even approximately a regular course.

The distinction between puerperal lymphangitis and phlebitis is of more scientific than practical interest, and very often the two are combined. Lymphangitis begins earlier—as a rule between the second and the fifth day; phlebitis, more commonly at or after the end of the first week. Lymphangitis is accompanied by pain in the lower abdomen; in phlebitis there is hardly any. In lymphangitis even a slight pressure on the abdomen provokes it; in phlebitis there is no tenderness of the abdomen, and the tender veins in the pelvis have to be sought with care. In lymphangitis there is a large uterus; phlebitis interferes less with involution. Lymphangitis spreads rapidly upward, and may cause peritonitis, pleurisy, pericarditis, and hypostatic pneumonia. It does not cause inflammation in the head or the limbs, nor infarctions and abscesses of the viscera. Lymphangitis begins commonly with a chill, but the repeated chills are characteristic of phlebitis. In lymphangitis the fever is more steady; in phlebitis there are marked and long intermissions.

ENDOCARDITIS.

The inflammation of the endocardium is a late puerperal affection. It appears between ten and fifteen days after delivery. It is marked by an exasperation of the febrile symptoms, but can only be recognized by means of auscultation, which reveals a harsh, rasping sound, especially at the apex, but sometimes at the base. Mostly it is synchronous with the first sound, but may also accompany the second. A peculiar feature of puerperal endocarditis is the mobility of the auscultatory signs: one day their seat may be the mitral valve, the next the semilunar valves, and *vice versâ.*

The endocarditis is mostly ulcerous. When the small infectious abscesses open into the current of the blood, their contents—microbes and their products—are carried throughout the system and form new localizations; but the symptoms of this new infection are overshadowed by those of the original one starting from a uterine phlebitis.

The endocarditis makes the PROGNOSIS still worse than it was before.

THE ALIMENTARY CANAL.

The alimentary canal is not much affected by puerperal phlebitis. We have, however, noticed the anorexia, thirst, occasional vomiting, and frequent diarrhœa. Sometimes thrush appears on the dry tongue.

We have likewise mentioned the occasional localization in the tonsils, the parotid gland, and the thyroid body. They are all late in appearance, and make the prognosis worse.

HEPATITIS.

The liver is very frequently more or less affected. There may be pain in the right hypochondrium; tenderness on pressure; an enlargement that can be demonstrated by percussion and palpation; sometimes real jaundice; and always a yellowish color of the skin. If there is peritonitis, the serous cover of the liver may be implicated. Sometimes this perihepatitis may be recognizable by the crepitation felt on pressure.

NEPHRITIS.

The kidneys are very often inflamed and contain abscesses. The only reliable symptom is the presence of albumen and casts in the urine. The other symptoms, such as headache, visual disturbances, vomiting, and lumbar pain, become mostly so merged in the general condition that they cannot be isolated and used as diagnostic symptoms. A persistent tenderness on pressure may make us think of a perinephritic cellulitis.

SPLENITIS.

The inflammation of the spleen may sometimes be diagnosticated by the increase in the size of the organ found by percussion and palpation. There may be pain and tenderness on pressure in the left hypochondrium. If an abscess opens into the abdominal cavity, it causes collapse and death. Mostly, the symptoms belonging to the affection of the spleen are merged in those of other organs and the general condition.

NERVOUS DISTURBANCES.

The nervous system is much affected in childbed. There may be neuralgia, paralysis, convulsions, tetanus, tetany, insomnia, delirium, carphology, etc. Often these conditions find their explanation in cerebral anæmia or hyperæmia, in hysteria, in reflexes, or in direct pressure on a nerve during the birth of the child. But when these conditions are found together with symptoms undoubtedly due to infection, or when the autopsy shows thrombosis of the veins of the brain or purulent meningitis, we cannot otherwise than acknowledge a connection of cause and effect between the infection and the nervous disturbances.

ARTHRITIS.

The localization sometimes takes place in joints. As a rule, only one or a few are affected, although many may be so from the first; but the disease does not jump from one joint to another, as does inflammatory rheumatism. The joint becomes swollen, tender, and red; every movement causes intense pain; there is a great tendency to suppuration; the abscess may open through the skin; and the deepest structures, bone and cartilage, may be destroyed. If the patient survives, she may have a stiff joint for the remainder of her life. The knee is most frequently the seat of the affection, but it may attack any other articulation of the limbs. Of those of the trunk, the symphysis pubis, the sacro-iliac, and the sterno-clavicular joint are most frequently inflamed. The synovial sheaths of tendons may be similarly affected.

DIAGNOSIS.—The fixity and the tendency to suppuration, besides the concomitant disturbances, distinguish puerperal arthritis from common rheumatism and gonorrhœic arthritis.

ABSCESS AND DIFFUSE CELLULITIS OF THE LIMBS.

When the subcutaneous and intermuscular connective tissue becomes inflamed, the limb swells; it is painful and tender; the skin becomes red and hot. The affection may be localized in one or more circumscribed points, where abscesses form and perforate the skin; or there may be a diffuse cellulitis extending over a large part of a limb. Sometimes it is only superficial, having its seat in the subcutaneous tissue. In other cases the deep connective tissue under the fascia is in a similar condition, and especially then the process may be highly destructive to life or limb if an energetic treatment is not resorted to in time.

SKIN DISEASES.

A puerpera may be attacked by the common erruptive fevers—measles, smallpox, scarlet fever, and erysipelas—just as any other woman. They are accidental complications which are not essentially connected with childbed.

Perspiration being a feature of the normal childbed, we sometimes see in women who otherwise are well the epidermis raised in small white vesicles like millet-seed (miliaria), with or without a red ring at the base or on continuously red skin. This miliary eruption is mostly found on the trunk.

It goes without saying that the common drug eruptions may as well appear in a puerpera as in any other person.

I have likewise seen an eruption, composed of small red papules and red streaks, especially on the extremities and in the face, much like measles. After a few days it was succeeded by a uniform erythema. It was accompanied by moderate fever and followed by a furfuraceous desquamation. After a few days there came a similar eruption. This and the total absence of catarrhal phenomena proved it to be different from measles.

In another case I have seen a similar papular eruption with a temperature of 105°. It began as maculæ that vanished on pressure, but reappeared immediately. Later it became papulous, and did not disappear on pressure. After a week it faded gradually, sank down to the level of the skin, passed through divers shades of yellow, until it finally disappeared. No other signs of puerperal infection were present.

In grave cases of puerperal infection the skin is often the seat of eruptions. An erythema may spread more or less far from the genitals. In other cases large erythematous spots may be found on divers places of the trunk and the extremities. In others, again, are found petechiæ, small dark-red or brown spots about the size of hempseed, which do not disappear on pressure. These I have only seen in very serious, mostly fatal, cases.

In other cases the epidermis is raised in large pemphigus-like vesicles, or forms bullæ filled with pus which burst and leave a sore.

In all these eruptions which accompany a general infection the symptoms referable to other organs mostly cover those due to the skin affection.

ACUTEST SEPTICÆMIA.

This form of puerperal infection used especially to be found during the so-called epidemics in hospitals. Nowadays it has become rare, and is never seen in well-directed institutions. It begins soon after delivery with an intense and long chill. There is no pain or only an insignificant one, and no swelling of the abdomen. The face has an anxious expression. The skin is pale or purplish, the tongue dry and brown, the features pinched. The pulse is rapid (120 to 160) and weak. The temperature may be high (104°), and stay high without the usual remittence, but it may be normal or even subnormal. The respiration is rapid. The patient falls often into a delirious or comatose condition. She has frequently involuntary evacuations of a thin, dark, offensive discharge from the bowels. The urine is scant and loaded with albumen.

The patient dies within a day or two after confinement.

TREATMENT.

In laying down rules for the treatment of puerperal infectious diseases we have to distinguish between hospital and private practice, the prophylactic and the curative treatment. As the curative treatment is essentially the same in hospitals and in private dwellings, it is only the prophylaxis which we will consider separately with regard to the peculiar circumstances obtaining in hospitals and the demands of private practice.

I. PREVENTION OF PUERPERAL INFECTION IN HOSPITALS.

The Hospital.—If possible, lying-in hospitals should be, as they now mostly are, separate institutions, without connection with a general hospital in which medical and surgical diseases are treated. Before the antiseptic treatment had been generally adopted in midwifery the mortality reigning in the obstetric wards of general hospitals was still greater than that of institutions exclusively used for parturient and puerperal women. It could not be otherwise when doctors and students went from performing an autopsy in the dead-house to delivering a woman in labor, keeping on the same clothes and only washing their hands in a more or less superficial and entirely insufficient way. By the conscientious and intelligent use of antiseptics a total change has taken place in this respect. Still, as we know that puerperal infection may be derived not only from women affected with the same disease, but from patients with suppurating or decaying tissues, from all putrefying substances, and perhaps from persons suffering from zymotic diseases, and as the rules given for the safe aseptic and antiseptic treatment of the parturient and puerperal woman may not in every instance be carried out with the same degree of precision, it is evident that patients taken care of in an institution solely consecrated to obstetric cases, other things being equal, are better protected against infection than those who are delivered in the wards of a general hospital and by the same physicians who have charge of the other cases.

The New York Maternity Hospital is, so to say, placed midway between the special lying-in institutions and the general hospitals with lying-in wards. We have a separate building, and we have a house staff who for the time being have nothing to do outside of the hospital. But, on the other hand, the visiting physicians are general practitioners, whose pursuits bring them in contact with all sorts of diseases. The house physicians come from the staff of Charity Hospital, a large general hospital, and serve only six weeks at a time in the capacity of junior assistant, senior assistant, and house surgeon. The nurses are pupils of the training-school which is common for Maternity and Charity Hospitals. The warden, the higher administration, the ladies' visiting committee, the helpers that carry coal, food, and scrub the floors, are common for both institutions. Taking all these unfavorable circumstances into consideration, we cannot expect, in spite of the most perfect rules for antiseptic treatment, to obtain quite as good results as in institutions that have no connection with general hospitals, and in which the service is uninterruptedly for many years in the hands of one man with a few assistants, who likewise occupy their positions for years and become experienced obstetricians themselves, capable of replacing their chief even in the performance of the most dangerous operations.

Even after the strict antiseptic treatment presently to be described had been in use for three years in the Maternity Hospital, I had the opportunity to see how dangerous the connection with Charity Hospital may become if the slightest relaxation occurs in the observance of the rules governing the relations between the two hospitals. Between September 6, 1885, and January 16, 1886, we had no less than 13 cases of puerperal diphtheria in about 200 confinements. Several of them were very severe, and 1 ended fatally. It made a particularly strong impression on my mind that when a new staff went on duty on the 1st of January, out of their first 6 patients 3 were affected in this way. I then found out that, without my knowledge and against the rules, the house surgeons had fallen back to the old habit prevailing before the new treatment was introduced, of allowing members of the Charity Hospital staff not only to visit the delivery-room, but even to deliver parturient women in the Maternity Hospital. As soon as this was discontinued, and the members of the Maternity staff had taken full baths with corrosive sublimate and had their clothes fumigated with sulphur, all septic trouble disappeared again, and since then there have only been a few isolated cases with long intervals.

A lying-in hospital should have as free access of pure air as possible, and it should circulate freely under the building, whether the latter be provided with a cellar throughout its length and breadth or it be raised from the ground on pillars. If the available means allow it, a good system of ventilation should be introduced. I have been informed by a competent architect that the only way to obtain fresh air in the wards of a hospital is by the so-called fan system, according to which large fans are driven by steam and throw the air from the cellar through openings into the wards. In winter-time it is heated before being moved by the fans.

In the Maternity Hospital, where we have no ventilating apparatus, we keep the windows open day and night, summer and winter. Although this interferes somewhat with the normal perspiration after childbirth, we have never seen any bad effect from it in the patients, but it is hard on the poor nurses.

Even the smallest lying-in hospital should have separate wards or rooms for patients with infectious diseases. If no such provision is made until disease actually breaks out in the institution, the first case or cases, especially if of a lighter type, are liable not to be isolated, and thus a so-called epidemic of puerperal fever may be started.

There ought likewise to be made provision for a rapid rotation in the use of different wards, in order that they may be disinfected before being used again. Even before the introduction of the new treatment in the Maternity Hospital, when we used the wards in a haphazard way, we always found that when we had a ward emptied, cleaned, and fumigated the patients in that ward were free from fever during the first week after the cleaning. Now a regular rotation in the use of the wards is an important part of our treatment. Our wards can accommodate respectively six and nine patients. A ward is not used for more than one set of patients: when the last of them has been there until the ninth day after her confinement the ward is disinfected in a way to be described hereafter, and left empty for one or more days. On the ninth day the patients are transferred to the convalescent ward, where they only stay a few days longer unless some pathological condition requires a longer sojourn in the hospital.

Pregnant women ought to be kept separate from parturient and puerperal women, and are so in our institution. They require other food; they are not so clean; they would disturb the quietude that reigns in the lying-in wards; and the sight of suffering would have a demoralizing effect on themselves.

There ought to be a special delivery-room. As it is commonly during parturition that infection takes place, a patient ought never to be confined in a ward in which there are puerperal women who might become a source of infection to the one in labor.

The communication between the delivery-room and the wards should be as easy as practicable, so as to avoid carrying the patient a long distance after her delivery. But, if possible, there should be no direct communication between them nor between the different wards. This system is followed in Tarnier's model pavilion in Paris, and was introduced by me in Maternity Hospital together with the change of treatment which took place on the 1st of October, 1883.

Good results may be obtained with another disposition of the localities, but where it can be obtained this one is preferable. No bad air can be diffused from one ward to the other. There is no temptation for carrying materials and vessels from one to the other, each forming a little world by itself. Doctors and nurses are obliged to be exposed to the purifying influence of the open air in going from ward to ward. In the Maternity Hospital I had the doors leading from one room to the other locked and sealed by filling all chinks with tow and covering this with strips of rubber adhesive plaster.

The wards ought to have plenty of light from opposite sides. The beds are best distributed in two rows or in a circle, one on each pier between two windows. Light from above is of no value except in an operating-room, and all cross-beams and projections which would become receptacles for dust ought to be avoided. Disease-germs are well preserved in such dust, from which they may find their way to the patients.

Floors and walls should be of a hard, smooth, little-porous material, so that they can easily be disinfected.

Where circumstances permit it is good to set one or more small rooms apart for serious operative cases.

The question of heating the hospital is an important and difficult one. I think some combination of different principles is advisable. Steam circulating in iron pipes is good to give a large and constant amount of heat, and is necessary in order to prevent the water from freezing in the pipes. Open fires are cheerful to look at; the rays of heat emanating from them give a pleasant sensation, which cannot be replaced by anything else; they purify the air in the ward by drawing it into the chimney; and it is a handy way to get rid of small dirty objects which otherwise might accumulate in the ward. Stoves are more economical, and can in most respects replace the open fires, but if overheated they exhale an unpleasant and unhealthy odor.

The new Maternity Hospital is to have the shape of a cross. A large delivery-room forms the centre of the whole establishment. From this go off three wards, with ten beds each, toward the south, east, and west.[1] Between the delivery-room and the wards there will be open porches, which will allow free circulation of air and make it possible for the physicians to get all over the establishment without passing through the delivery-room. At the northern end there will be a room for the doctors, one for the head-nurse, and two for operative cases. At the southern end there will be four rooms for infectious diseases, each for one patient. Each ward and the department for infectious cases have their own little kitchen for warming food, making poultices, and so forth, their own bath-room, sink, and water-closet, outside of the ward.

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[1] So was the distribution on the plan the architect made under my direction. A higher power has turned the building ninety degrees, which gives the doctors and the nurses the exhilarating morning sun, and leaves half of the isolating rooms, in which the most serious cases are treated, exposed to the cold north winds.

The waiting women and the convalescent women will be in separate buildings, as they now are.

The department of a lying-in hospital destined for infectious cases ought to have separate beds, furniture, and instruments. The patients ought to be under the care of special nurses and a special house physician. The visiting physician ought to be the only one who attends to the whole service.

Water-closets ought to be of the very best and simplest construction, and never situated in the wards. To screen them off with a few boards, as is sometimes done, is of course a nearly imaginary precaution. They ought to be placed not only outside of the wards, but separated from the latter by a space to which open air has free access. Both doors intervening between the ward and the water-closet ought to close automatically; otherwise they will be left open by patients and nurses.

Provision must be made for a place to disinfect all linen and bed-clothes used by patients with infectious diseases before they are washed in the common laundry of the hospital.

As the women commonly stay only a very short time in the hospital after their delivery, and as a lying-in room ought to be kept as quiet as possible, no visitors ought to be admitted except in protracted cases. Most of such visitors would come from crowded tenement-houses, in which very often are found diphtheria, scarlet fever, and other zymotic diseases, the germs of which might be brought to the hospital.

The house staff ought never to make autopsies, handle specimens, or even enter the dead-house; nor ought they to be allowed to visit hospital wards in other places in which sick people are confined.

Disinfection.—The marvellous results obtained in lying-in hospitals nowadays are chiefly due to cleanliness and antisepsis. A nail-brush has become the most indispensable of all obstetric instruments. In order to give practical rules for disinfection, and abstain from vague generalities which are unfit to guide anybody, I do not think I can do better than describe minutely how it is carried out in the Maternity Hospital.

The principle upon which we act is the theory that infectious diseases are due to germs which may be found on the surrounding objects, in the air, on the patient herself, on the doctors and nurses. We will therefore have to consider the disinfection of the wards and furniture, of the patient and her helpers, and of all materials or instruments that come in contact with her.

Ward.—When the last patient admitted to a ward has reached the ninth day after her confinement, it is fumigated by burning twenty pounds of sulphur in the smaller and thirty pounds in the larger wards. This is done in an apparatus made of iron and composed of two horizontal pans connected by means of three uprights about half a yard high. The sulphur is placed in the upper pan and moistened with alcohol. The lower is filled with water, which would put out the fire if the sulphur got through the bottom of the upper pan. All windows and doors are closed and the alcohol lighted. · From half a day to a day later the doors and windows are opened, and, if the ward is not needed immediately, they are left open for one or more days. The floors and all the furniture—bedsteads, tables, chairs, etc.—are scrubbed with soap and water, and thereafter again scrubbed with a solution of bichloride of mercury, 1 part to 1000 parts of water. As soon as a patient leaves the lying-in ward the bed-clothes, inclusive of the ticks of the mattresses, are sent to the laundry, and the straw in the mattresses is burnt. When the ward has been fumigated and washed all the beds are made up with clean clothes and fresh straw. Bed-clothes used by sick puerperæ are immersed for an hour in the same bichloride solution in large casks placed in the small room between the sick ward and the water-closet, and given a preliminary washing before they are sent to the laundry. Patients and nurses use only clothes that can be washed. If doctors want theirs disinfected, it is done with sulphurous acid by suspending them in a room in which sulphur is being burned.

Patient.—When a patient is taken in labor she is given a full tepid bath and scrubbed with soap. In order to remove still more effectively the fatty film covering the epidermis, it might be good to add soda to the soap and water with which she is washed, as recommended by Fritsch.[1] After the bath she is dressed in clean clothes and placed on a clean bed, under the sheet of which is placed a rubber sheet disinfected with bichloride (1 : 1000). She is given an enema of soapsuds. Her abdomen, thighs, buttocks, and especially all the sulci at and near the genitals, are carefully washed with bichloride (1 : 2000). About two quarts of the same fluid used to be injected into the vagina, but has of late been replaced by a 2 per cent. solution of creolin.

While all agree as to the necessity of disinfecting the patient's skin, opinions differ in regard to the advisability of using the vaginal injections. Thus, Fritsch[2] is opposed to them, except on special indications (leucorrhœa, gonorrhœa, fever). He thinks they are not only useless, because the bacteria found in the vagina are innocuous, and the vagina, on account of its numerous folds, cannot be disinfected by injections, but even dangerous, in so far as they remove the mucus that makes the vagina soft and slippery. All this does not convince me. I do not think it practicable while attending a woman in labor to decide what kind of bacteria are found in the vagina, and I fail to see why we should do less to remove them from the latter than from the skin and the vulva. I take it to be very desirable to have the vagina as well disinfected as possible. We must remember that during examinations mucus is carried from the vagina into the interior of the womb, which has an entirely different epithelium and numerous lymphatics that absorb with great ease. During the passage of the child the vagina itself is enormously distended and becomes the seat of abrasions and tears. Germs which were harmless on the intact surface of the vagina might therefore be pressed into the tissue and give rise to disease. Injections may not accomplish a perfect disinfection, but when the patient is lying on her back, raised on a bed-pan, and the nozzle of the syringe is brought 'way up to the vault of the vagina, it takes quite a little time before the water flows out, and a large amount is retained. It distends the vagina, enters the folds, and bathes the ridges. It is true that the water with its astringent qualities removes the mucus and hardens the walls of the vagina, but new mucus is secreted in such quantities that we can see it flow out in front of the presenting part. I think, therefore, that all we have to do is to abstain from too frequent injections during labor, and especially toward its end. A first good cleansing by means of disinfecting fluids is, in my opinion, a useful safeguard against infection.

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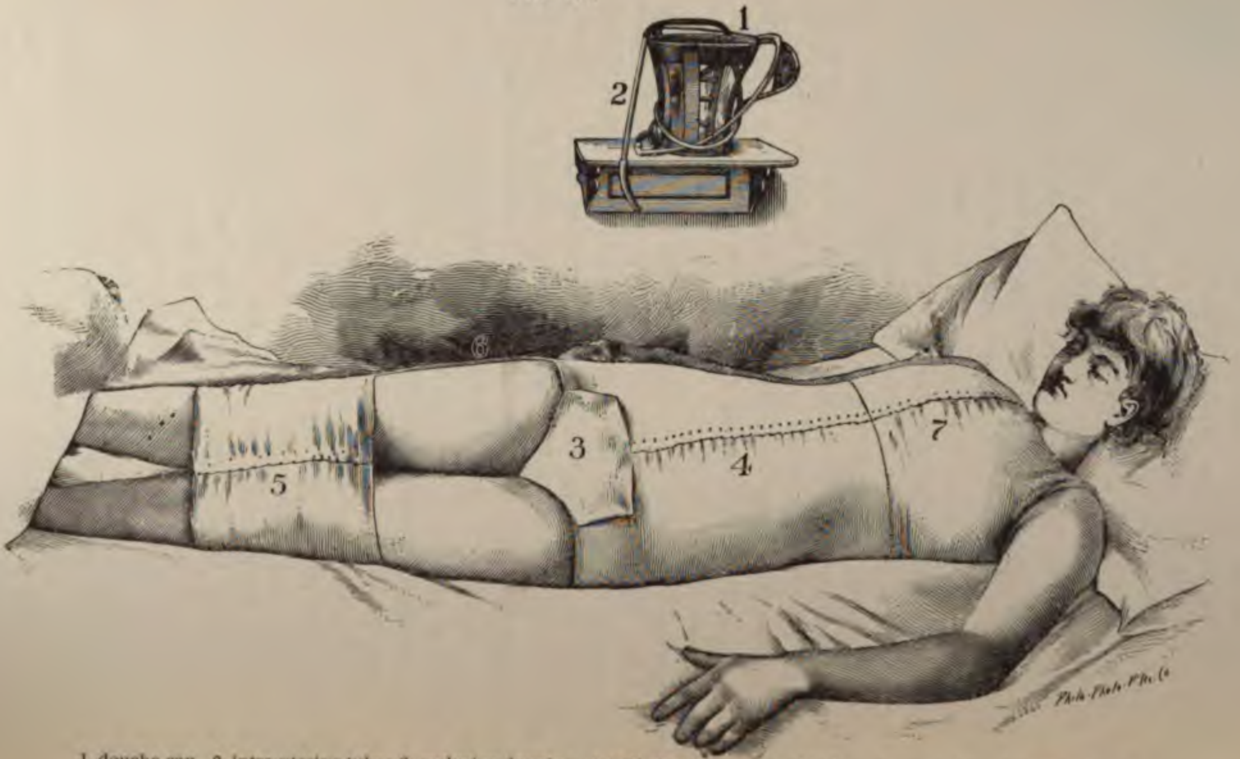
[1] H. Fritsch: *loc. cit.*, p. 127.

[2] *Loc. cit.*, p. 129.

The injections are made by means of fountain syringes of agate-ware. At first I had them made of glass and set in metal cradles, as shown in Fig. 100, but the manufacturers soon refused to take the trouble to make them, the demand being so small. Then I introduced thick glass irrigators with handles which are imported from Germany, but they are expensive, and we soon found that they cracked near the handle when hot water was poured into them. Of late I have had cans of agate-ware altered for our purposes. They come into the market destined for beer-measures, and hold nearly two quarts. A strip of glass in the side allows one to see the level of the water. I ordered a hole drilled near the bottom and a curved hard-rubber tube cemented in it. To this a soft-rubber tube is fastened, and at the other end slipped over a common straight glass tube about six inches long, for vaginal injections. The common soft-rubber bags are less good for hospital use, because it is impossible to wipe off their interior and it takes more time to fill them.

Doctors and Nurses.—If there is slight divergence of opinion as to the amount of disinfection to be applied to the patient, all agree about the importance of a thorough disinfection of the accoucheur himself. He ought to take off his coat and cuffs, roll up the sleeves of his shirt and undershirt, and clean and disinfect his hands mechanically and chemically. It is not enough to use soap and rub our hands a little against one another, as in ordinary cosmetic washing. The whole hand must be carefully scrubbed with a stiff nail-brush, the doctor taking particular

FIG. 100.



1, douche can 2, intra-uterine tube; 3, occlusion dressing; 4, belly-binder; 5, knee-binder; 6, suspenders; 7, breast-binder.

care to scrub the spaces under the nails and the creases at their root—localities from which dirt is removed with greater difficulty than from the smoother parts of the hands. By this mechanical cleansing extraneous dirt and dead epidermis-cells are removed from the skin. After the washing the hands are wiped dry, and the spaces under the nails carefully scraped with a suitable instrument. Common penknives are too sharp: they are apt to deprive the inside of the nail of its smoothness, and even to cut the skin. Scrapers of bone are not sharp enough. An excellent steel scraper is that patented by Curley and found in some of George Wostenholm's pocket-knives. It removes the dirt with ease and rapidity, and cannot wound the finger.

Thus prepared, the hands are immersed for at least three minutes in a solution of bichloride of mercury (1 : 2000), in which the scrubbing may be repeated.

Since corrosive sublimate loses some of its antiseptic properties by being mixed with soap,[1] the cleansing and disinfection ought to be, as here described, two separate acts; and it is not good, as some recommend, to wash the hands with soap in the solution of corrosive sublimate.

If we have the choice, the best kind of soap for disinfection is the soft potassa soap. It possesses, in fact, itself considerable antiseptic properties. Robert R. Koch,[2] than whom there is no higher authority in bacteriology, found that a solution of 1 : 5000 began to hamper the development of bacilli, and that one of 1 : 1000 prevented it completely. In my opinion, we cannot have a better proof of the high practical value of this soap as an antiseptic than the excellent results obtained in the large lying-in hospital of Vienna, where they have had a series of five hundred confinements without a death[3] [from sepsis?]. Since the standard antiseptic used in that institution is only a 1 to 2 per cent. solution of carbolic acid,[4] which has been proved experimentally to possess very weak antiseptic properties, it would seem that the results obtained are due more to the soap than to the carbolic acid. This soap has, indeed, other virtues besides that of being a germicide. It is so sticky that once smeared over the skin it is very difficult to remove, and in doing so the accoucheur gets cleaner hands than with the more or less hard soda soap in common use. It is likewise the cheapest of all soap when not bought by the ounce in the drug-stores as an ointment used in skin diseases.[5]

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[1] Dr. Boxall: *New York Medical Record*, 1888, vol. xxxiv. p. 481.

[2] R. R. Koch: "Ueber Disinfection," in *Mittheilungen aus dem kaiserlichen Gesundheitsamte*, 1881, vol. 1. p. 271.

[3] Kucher: *Puerperal Convalescence, and the Diseases of the Puerperal Period*, New York, 1886, p. 236.

[4] Ehrendorfer: *Archiv für Gynäkologie*, 1885, vol. xxvii. p. 218.

[5] The soft soap made in this country is of a dirty greenish-yellow color. I do not know if it possesses the same germicide power as the green German soap used in Koch's experiments, but it possesses the same stickiness and its wholesale price is only six cents.

For a mere examination or for a normal delivery it is sufficient to disinfect the hands in the manner described, but in any kind of operation, and especially in that of turning, both arms ought to be disinfected up to the elbow.

If the accoucheur has had to deal with a case of puerperal fever, diphtheria, scarlet fever, or other disease liable to infect the patient, he ought even, if possible, to take a full bath with two drachms of bichloride, and wash his hair and beard with great care while he is in the bath. Under similar circumstances we ought likewise to take particular precautions in regard to our hands, such as to scrub them still more thoroughly, to use a stronger solution (1 : 1000), and to hold the hands longer in it, say five minutes. A common disinfection takes at least five or six minutes; after having been particularly exposed the doctor ought to devote no less than ten minutes to this all-important act.

By the process described the hands are efficiently disinfected, but we must remember that merely by putting the hand into the pocket in order to take out and replace the nail-cleaner, or by touching towels, bed-clothes, and other objects before introducing the finger into the genital canal, fresh infectious matter may adhere to it. We have, therefore, standing at the bedside, a basin with lukewarm solution of bichloride (1 : 2000), in which we immerse the hand the very last moment before bringing it in contact with the genitals.

Nurses ought to disinfect themselves with the same care and in the same way as physicians.

Materials.—All materials coming in contact with the genitals, such as absorbent cotton, lint, etc., are wrung out of the same solution of bichloride before being used.

Instruments, especially when nickel-plated or made of silver or tin, are more or less corroded by corrosive sublimate. They are therefore disinfected with carbolic acid. For a rapid disinfection it ought not to be used in a weaker solution than 5 per cent., but during an operation it is sufficient to have a 2½ or 3 per cent. solution. Since both instruments and the hands of the surgeon are attacked by carbolic acid—the latter in my experience much more so than by bichloride—an unnecessarily strong solution should be avoided. After operations the instruments should be carefully scrubbed with soap and water and carbolic solution, and rinsed with plain water. Complicated instruments must be taken apart. For Simpson's axis-traction forceps it is necessary to have a key made if it does not come with the instrument, by means of which the traction-rods can be unscrewed after each operation, and the joint, to which blood and other fluids find access, be thoroughly cleansed and disinfected.

In ordinary labors *sponges* are superfluous, and so dangerous as carriers of septic matter that they ought to be absolutely ostracized. Even in minor operations, such as perineorrhaphy, they are replaced by absorbent cotton and lint wrung out of the 2 per cent. solution of creolin or carbolic acid. In laparotomies they can hardly be entirely dispensed with, although their use may be much limited by substituting pads of gauze wrung out of the antiseptic solution.

If sponges are used, the utmost care must be bestowed upon their disinfection. New sponges, as they come on the market, need a good deal of hammering and washing to remove sand and make them soft. Even if bought thus prepared, they often contain calcareous incrustations which are dissolved by immersing the sponges for an hour in a weak solution of hydrochloric acid, one ounce to every quart of water. After that they must yet be wrung out of water as long as any sand comes out of them. Next they are left for an hour in bichloride of mercury (1 : 1000), wrung out, dried by exposure to heat, and kept in a muslin bag for future use.

If old sponges are to be used again, they may be cleaned and disinfected in different ways. The way I do is to wring them out in warm water till it remains entirely colorless and apparently pure. Then I leave them for an hour in a solution of potassa (liquor potassæ ℥j to each quart of water), which draws out all the blood. In exceptional cases, when the sponges have become very much saturated with blood, it may become necessary to change this solution. They are then wrung out of plain water until it remains entirely colorless, and disinfected with corrosive sublimate as above.

By keeping the sponges dry they do not rot so rapidly as when kept in carbolized water. Before the next operation they are left for a short time in a strong solution of bichloride (1 : 2000), wrung out, and kept in a weak solution (1 : 5000 or 10,000) of the same, or in carbolized water (2½ to 3 per cent.), during the operation.

For *sutures* and *ligatures* I prefer silk. It is easily obtained, easily made aseptic, and easily tied. It is hardly safe to rely on the silk sold as aseptic in the shops: the operator must take the trouble to prepare it himself. Some of the busiest surgeons in the world find time to do this, and take particular care in examining the material. I prepare my silk by boiling it in a china casserole for half an hour, immersing it for another half hour in a solution of corrosive sublimate (1 : 1000), and keeping it wound on glass spools in well-corked glass bottles filled with alcohol.

Catgut takes much more time to prepare. One of the speediest methods is that of Kocher. The raw catgut as found in the shops is immersed for twenty-four hours in juniper oil; that is, the oil gained by distillation from the unripe fruit of *Juniperus communis*. That produced from the tops or wood is an inferior article, not fit for our purpose. At the end of the time indicated the catgut is rinsed with and kept in alcohol.[1]

For some operations, such as suturing the uterus after the Cæsarean section, if catgut is at all used, it is necessary to have some that will resist absorption longer than common catgut. Such a preparation is Lister's chromicized catgut. It is prepared by dissolving 1 part of chromic acid in 4000 parts of distilled water, and adding 200 parts of carbolic acid. Catgut equal in weight to the carbolic acid is left for forty-eight hours in the mixture. The preparing fluid causes a certain amount of softening and uncoiling of the twisted cord, and a still greater degree of uncoiling takes place during drying. This may lead to the gut giving way when subjected to a strain. It ought therefore to be dried on the stretch by tying the ends of each hank to two fixed points in the room. When dry it is placed in 1 : 5 carbolic oil. Erosion of this catgut does not begin till about a fortnight after its introduction into the tissues.[2]

Silver wire is disinfected by immersion in alcohol or by passing it through the flame of an alcohol lamp.

During an operation all ligatures and sutures are kept on plates with alcohol.

Iodoform is used to advantage in several obstetric operations. A torn perineum may be powdered with it before the sutures are closed. After Cæsarean section the wound in the abdominal wall may be dusted with it and covered with iodoform gauze. Much surprise was caused in 1887 by the discovery of Heyn and Rovsing of Copenhagen[3] that iodoform did not prevent the development of bacilli in artificial cultures, but it seems that it is decomposed by the very appearance of pus-cocci and the formation of ptomaïnes in such a way as to become a germ-killer.[4] However the theoretical explanation may turn out, experience has abundantly proved that iodoform is a most valuable preventive of suppuration and sepsis.

The value of the preventive antiseptic treatment is proved by the unanimous testimony of all institutions that have adopted it. Both as to mortality and morbidity the most remarkable change has taken place. As late as 1875 the International Congress of Physicians declared that large lying-in hospitals ought to be abolished; to-day the mortality of some of the largest has dwindled down to be a fraction of 1 per cent.; and if we compare the results obtained in private houses and in hospitals among the class of patients who seek admission to the latter, they are much better in hospital than in private practice. Especially for dangerous operations, such as Cæsarean section, craniotomy, and the removal of the adherent placenta, hospitals have become the safe places where obstetric art celebrates its greatest triumphs.

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[1] Wood and Bache: *U. S. Dispensatory*, 13th ed., 1874, p. 1308; *Hospital Formulary of the Department of Public Charities and Correction*, 3d ed., 1886, p. 96.

[2] W. Watson Cheyne: *Antiseptic Surgery*, London, 1882, p. 57.

[3] *New York Med. Record*, 1887, vol. xxxii. p. 36.

[4] *Centralblatt für Gynäkologie*, 1887, vol. xi. pp. 514, 515.

The records of the Maternity Hospital show the following mortality before and after the introduction of strict antisepsis (bichloride of mercury):

Year.	Deliveries.	Deaths.	Per cent.
1875	570	15	2.63
1876	536	20	3.73
1877	480	32	**6.67**
1878	255	7	2.75
1879	254	11	4.33
1880	149	8	5.37
1881	382	9	2.36
1882	431	14	3.25
1883	447	30[1]	6.71
Total	3504	146	4.17

During the last six months, before the change in treatment was made, there were delivered 237 women, 19 of whom died, or 8 per cent., and of these 17, or 7.17 per cent., succumbed to sepsis. During the last month the total mortality reached even 20 per cent., and that from infection 15.69 per cent.

During the first three months after the change, from October 1, 1883, till January 1, 1884, we had 102 deliveries without a single death. From that time the mortality has been as seen by the following list:

Year.	Deliveries.	Deaths.		Per cent.	
		Total.	From Sepsis.	Total Mortality.	Sepsis.
1884	522	8	4	1.53	0.76
1885	537	3	0	**0.56**	0.0
1886	446	5	1	1.12	0.22
1887	389	5	1	1.30	0.26
1888	377	3	0	0.79	0.0
Total	2271	24	6	1.06	0.27

Thus the total mortality has become little more than one-fourth of what it used to be; and while in former years the cause of death was nearly always some form of disease which we now regard as due to infection, *deaths from sepsis have now been reduced to nearly one-fourth of 1 per cent.* During the years 1885 and 1888 there was not even a single death of this kind.

No less remarkable is the change in regard to morbidity. Thus, for instance, during the six months from October 1, 1882, till April 1, 1883, a period of which I have exact notes, 192 women were delivered. Of these 46, or *nearly 1 out of 4*, were seriously ill, and 39, or nearly 1 in 5, suffered from puerperal inflammation, which nowadays, at least, is subject to grave suspicion in regard to infection. Since the change in treatment we have had very few sick puerperæ, and with few exceptions the cases have been mild. We have every year had cases which, from all symptoms, such as pain, tenderness, and swelling, had to be diagnosticated as cellulitis, and still the thermometer showed no rise in temperature—a phenomenon which I can only account for by supposing that the inflammation was of purely traumatic origin, due to the bruising of the genital canal by the passage of the child, and that the aseptic way in which labor is conducted, as well as the precautions we take during the lying-in period, excludes all infectious germs which develop so easily in bruised tissues.

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[1] All these occurred in patients delivered during the first nine months of the year.

At the hour of writing it is just five years since I introduced the bichloride-of-mercury treatment in the Maternity Hospital. During that time it has been kept up without any change, and the results have been so satisfactory that I feel very little inclined to make any. Still, it may become necessary to substitute another antiseptic for the bichloride used in injections. So many cases of death from *poisoning* by this drug have been reported that the subject demands our most serious and conscientious consideration. In many of these cases unreasonably strong solutions or an unjustifiable amount of fluid was used. Protracted irrigation of wounds has proved particularly dangerous, both by clinical observation on men and by experiments on animals.[1] An anæmic condition of the patient makes absorption stronger, and therefore increases the danger of poisoning. But even when all precautions were taken, and in healthy patients, poisoning has occurred. The most remarkable case I know of is that reported by Fleischmann from Breisky's clinic in Prague.[2] In 1620 confinements they had used bichloride without any poisoning, when the following sad case occurred: The patient was a primipara, seventeen years old, in good health, and especially without any symptoms of kidney disease. Before and immediately after an examination the vagina was douched with a liter (little more than a quart) of a 1 : 2000 solution of corrosive sublimate. It was noticed that after the first injection there came a little bloody discharge from the genitals, probably due to granulations of the cervical portion. These two injections given before delivery were all she got, and still she developed symptoms of poisoning immediately after, and died a week later. The autopsy revealed the pathognomonic calcareous deposits in the kidneys and diphtheritic ulcers in the intestinal canal. In Berthod's case[3] death occurred, although only six vaginal douches and one intra-uterine injection of a 1 : 2000 solution had been given. The autopsy showed nephritis and intestinal ulcers.

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[1] Doléris and Butte: *Nouvelles Archives d'Obstétrique et de Gynécologie*, 1886, p. 739.

[2] Fleischmann: *Centralblatt für Gynäkologie*, 1886, vol. x. p. 761.

[3] *Centralblatt für Gynäkologie*, 1887, vol. xi. p. 768.

At one time it was thought that only the intra-uterine injections caused the evil, but the above case from Breisky's clinic and observations of O. von Herff of Darmstadt, G. Braun, and others[1] prove that the vaginal injections are by no means free from danger. The same is, to some extent, corroborated by the experiments of Doléris and Butte on animals.

Personally, I have never had a fatal case of bichloride-poisoning in my hospital service, and I have only seen one case showing symptoms undoubtedly due to the toxic effect of this drug. In that case there was soreness of the gums and salivation—a symptom which, strangely enough, is said to be rarely found in cases of poisoning by injections and similar procedures (Butte). The few other cases I have seen were in women affected with "puerperal fever;" and as the only symptoms were bloody diarrhœa and intestinal tenesmus, which might be due to the disease itself, it is really not said they were produced by the use of bichloride. But, seen in the light we now possess, I strongly surmise that one or two cases of death that have occurred in the Maternity Hospital were unrecognized cases of poisoning with bichloride. Thus, the following résumé of a case has been furnished me from the books of the hospital: M. D——, æt. 28. Placenta expelled spontaneously, together with child. Following delivery the patient had watery discharges from the bowels—*twenty-nine during the first two days.* Vomiting. No fetor to lochia. Clinical diagnosis, dysentery. Patient died. Autopsy was not allowed.

Last fall I saw in consultation the following case of fatal poisoning by corrosive sublimate. The patient was thirty-five years old, robust, a primipara. The os began to dilate toward the night of October 1, 1888. As on the next morning it had barely reached the size of a fifty-cent piece, the physician introduced two fingers into the cervix and assisted dilatation as much as possible. When this was accomplished, he delivered by means of the high-forceps operation at 2 P. M. When the patient was put in bed all outer parts liable to be touched during delivery had been disinfected with a solution of bichloride 1 : 2000, but no vaginal douche had been given. After completion of labor one gallon of a 1 : 4000 solution of bichloride of mercury was prepared, and one ounce of carbolic acid added to it. The vagina was syringed out with part of this fluid, and the tube passed into the womb. After a very few moments the patient complained of abdominal pain, and slowly passed into the condition of syncope, followed by clonic muscular contractions of the limbs. Seeing the patient lose consciousness, the doctor withdrew the tube when less than one-half of the fluid had been used.

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[1] *Centralbl. f. Gynäk.*, 1886, vol. x. p. 618.

The patient recovered at once, and apparently felt well. When the doctor visited her in the evening her condition seemed good, but she had not passed any urine, felt no desire to do so, and the catheter introduced into the bladder brought only a teaspoonful of a grumous, dark fluid.

During the two following days (October 3d and 4th) hardly any urine was secreted, and it remained of a similar quality as before. On the 3d the temperature rose to 101.5° Fahr., and on the 4th to 102.8°. The pulse ranged from 116 to 130, changing at short intervals. On the 4th the patient complained of a sore mouth; the gums were soft and pulpy, the tongue was loaded, the teeth were sore to touch; the mucous membrane of the cheeks showed abrasions, and there was salivation. She had four or five offensive diarrhœic stools. Chlorate of potash was ordered as a gargle and in one-grain doses every hour internally.

On the 5th and 6th the same condition obtained. On the last-named day she was taken out of bed by her friends, and stood upon the floor while the bed was being made. Thereafter the abdomen became swollen, tender, and tympanitic. Morphia was given in one-sixth grain doses twice with two hours' interval, and later every four hours.

I saw her on the 7th. In the morning a little clear urine had been drawn, and later she had passed about one ounce voluntarily. She was drowsy, probably from the effect of the morphine, easily awakened, and intellectually clear. She was assuming a waxy color, with some slight puffiness of the face and extremities; pulse 135, temperature 101.5. I made the diagnosis of acute poisoning with bichloride, and got the impression that the case was hopeless. She took milk and stimulants abundantly, continued the chlorate of potash, and had ice-bags applied to her abdomen.

The next morning (October 8th) the pallor of the entire surface became intense, and extended to the mucous membrane of the buccal cavity. The puffiness and resiliency of the skin were so marked that they produced glossiness of the surface, like that seen in phlegmasia alba dolens. Gradually she lost consciousness, became comatose, and died at 11 A. M. Autopsy not to be obtained.

Even if we will admit the possibility that her peritonitis may have been caused by her getting out of bed on the 6th, this does not materially change the condition. We have the shock and convulsions during the injection, the nearly complete suppression of urine, the bloody, grumous appearance of what little was secreted, and the characteristic stomatitis,—more than enough to warrant the diagnosis even in absence of an autopsy.

The symptoms observed in cases of acute poisoning with corrosive sublimate in obstetric cases are abdominal pain, tenesmus, stinking diarrhœa with or without blood, vomiting, diminished secretion of urine, albuminuria, hyaline casts in the urine, perspiration, erythema, low temperature, frequent, small pulse, restlessness, choking, headache, thirst, somnolence, contracted pupils, redness or a blue color, soreness and swelling of the gums, loosening of the teeth, metallic taste, ulcers or gangrenous sloughing of the mucous membrane of the mouth, ulceration of the vagina and rectum, collapse and death.

The chief changes revealed by the autopsy are seated in the intestines, the kidneys, and the brain. The large intestine is the seat of extensive ulceration; the cortical substance of the kidneys is swollen, and the tubules contain masses of oxalate of lime. If these are found, they are pathognomonic of poisoning with corrosive sublimate, but they may be absent.[1] The brain is unusually dry.

As to the treatment of acute poisoning by bichloride of mercury, the first indication is, of course, the discontinuation of the use of the drug and the substitution of another antiseptic, such as carbolic acid, acetic acid, or creolin. Diarrhœa and pain are combated by opiates, partially by the mouth, where the local effect at the same time counteracts salivation, and especially enemas of corn starch, a teaspoonful to half a pint of water, with laudanum, twenty-five drops or more, repeated three times a day. Vomiting may necessitate the hypodermic administration of morphine, and is furthermore treated with bismuth, hydrocyanic acid, strychnia, creasote, carbolic acid, hot black coffee, and counter-irritation of the pit of the stomach. The prostration calls for strong stimulants. The choking might perhaps be benefited by nitrite of amyl. If the urine is scant, diuretics ought to be given. I have seen the headache promptly yield to antipyrine in acute mercurial poisoning. The stomatitis should be treated with a gargle with chlorate of potash (ʒij to ℥viij), or, if there are considerable ulcers, with the application of compresses soaked in the saturated solution (1 : 17).

If we take into consideration how many women have been saved by the preventive use of bichloride who otherwise would have succumbed to puerperal infection, the whole number of deaths reported is so small[2] that if we had to choose between the bichloride treatment, with all its dangers, and the return to the state of things before antiseptic midwifery began, no man in his senses could hesitate for a moment. In this case statistics furnish such overwhelming proof as to render all scepticism impossible. Still, we ought not to let our patients run unnecessary risks, and a case of this kind occurring in private practice might place the accoucheur in a very embarrassing position.

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[1] Prévost: "Étude expérimentale relative à l'intoxication par le mercure, calcification des reins parallèle à la décalcification des os," in *Revue médicale de la Suisse romande*, 1882, No. 11; *Centralb. f. Gynäk.*, 1884, p. 230; Fr. Dahl, *ibid.*, p. 195; L. Butte, in *Nouvelles archives d'Obstétrique et de Gynécol.*, 1887, p. 181.

[2] L. Butte (*Nouvelles archives d'Obstétrique et de Gynécologie*, 1887, p. 181) in a special historical research found only 13 cases; F. Engelmann of Kreuznach says he knows of 17 (*Centralbl. f. Gynäk.*, July 7, 1888, vol. xii. p. 433). That would still average less than 4 deaths annually since Stadfeldt sounded the note of alarm (*ibid.*, Feb. 16, 1884, vol. viii. p. 101).

Some institutions, such as the lying-in hospitals of Copenhagen and Vienna,[1] have returned to or never given up carbolic acid, by which drug they achieve as good results as others who use the more dangerous corrosive sublimate. Still, I do not think it would be wise for us to follow their example. On account of the intimate connection with Charity Hospital, a large general hospital in which all kinds of diseases are treated, we are more exposed to septic influences than those who work in institutions that are strictly lying-in hospitals and nothing else. We need, therefore, the protection offered by the most powerful antiseptic.

Carbolic acid had been more or less in use in the hospital for years before bichloride was introduced. I myself used it even very systematically. When I was appointed visiting surgeon in 1881, I introduced the following treatmemt: Before and after each vaginal examination doctors and nurses washed their hands in a 2 per cent. solution. The same was used for vaginal injections, one of which was given immediately before and after delivery and morning and evening during the first eight days after delivery. Instruments were disinfected in a 5 per cent. solution. In those cases where the hand or instruments had been introduced into the uterus this organ was washed out with a quart of a 2 per cent. solution. All the patients had their genitals covered with a compress dipped in 10 per cent. carbolized oil, which was kept in place by a large pad of oakum inserted between the thighs. This treatment was used during six months in about 200 cases. The mortality was 4 per cent., and all the deaths, with the exception of one, were due to septicæmia.

During my second term of service, from October 1, 1882, till April 1, 1883, the vaginal injections and the carbolized compress were discontinued, but carbolic acid was still used for disinfection of the hands and instruments, and the genitals were dusted with a mixture of 1 part of salicylic acid and 4 parts of corn starch. During this period 192 women were delivered, 15 of whom died—a mortality of 7.8 per cent. The morbidity was so great that 1 out of every 4 puerperæ was seriously ill. I remember that the solution furnished us from the drug-store of Charity Hospital was sometimes badly mixed or the drug of inferior quality. So much is sure, that it sometimes scalded the patients and gave rise to smarting wounds, which, by lowering the vitality of the patient, may have contributed to the high mortality. The smell of carbolic acid sticks to your hands, and is to most people quite disagreeable, especially when mixed with that of the lochia. Many, including myself, feel their skin, their nerves, nay, their whole constitution, unpleasantly affected by the use of this drug. It is even poisonous. I do not know, however, if it has caused death directly when used in midwifery, but Mäurer came very near losing a patient in this way,[1] and Veit[2] has made similar observations. For all these reasons I do not feel inclined to return to carbolic acid.

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[1] Stadfeldt, *loc. cit.*; Ehrendorfer: *Archiv für Gynäk.*, 1886, vol. xxvii. p. 193.

How much more effective bichloride of mercury is than carbolic acid, both to ward off disease and to diminish its severity, appears also from a recent report from Innsbruck in Austria. Of 2183 parturient women, 768 were treated with carbolic acid, 1415 with corrosive sublimate. Of the former, 155, or 20.1 per cent., were taken sick, and 117, or 15.1 per cent., of them suffered from puerperal diseases. Of the latter only 98, or 6.9 per cent., were sick, and only 44, or 3.1 per cent., suffered from puerperal diseases. Of those treated with carbolic acid, only 43 of 117, or 36.7 per cent., recovered in less than twenty days, whereas of those treated with corrosive sublimate more than one-half were well within the same space of time.[3]

All that has been said against bichloride of mercury applies, of course, to the biniodide, which is still more poisonous, indissoluble in water, and more expensive.

Permanganate of potash has been praised in puerperal fever by Chadwick, Sinclair, and Goodell.[4] I have had no personal experience with it, and do not know if it would answer all purposes. What we must try to find is a substance that is a reliable germicide, but not poisonous to the human organism; that does not irritate wounds nor corrode instruments; that is easily dissolved in water; capable of mixing with oleaginous substances; a deodorizer, but without smell itself; and easily obtainable at a low price.

Some years ago Dr. George P. Fowler[5] of Brooklyn, N. Y., made a strong plea for hydronaphthol, and his observations were confirmed by Dr. R. J. Levis of Philadelphia.[6] It is said to rank next after corrosive sublimate as an antiseptic. It is, however, a proprietary drug, and cannot be prescribed in our public charitable institutions.

Dr. F. Engelmann of Kreuznach recommends acetic acid in 3 and 5 per cent. solutions,[7] but he has only had very limited experience with it himself, and I have had none. It is very cheap, but the odor is rather disagreeable, and I would expect it to smart and irritate wounds.

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[1] Mäurer: *Centrablatt für Gyn.*, 1884, vol. viii. p. 487.

[2] Veit: *Berliner klinische Wochenschrift*, 1879, No. 3.

[3] Torggler: *Allgemeine Wiener med. Zeitg.*, 1888, Nos. 26 and 27; *Centralbl. f. Gynäk.*, Nov. 17, 1888, vol. xii. p. 760.

[4] *Trans. Amer. Gynecol. Soc.*, 1879, vol. iv. pp. 119, 123, 133.

[5] Fowler: *New York Medical Journal*, 1885, vol. xlii. p. 374 *et seq.*

[6] *Ibid.*, p. 593.

[7] *Centralblatt f. Gynäk.*, 1888, vol. xii. p. 433.

I am now trying creolin. This is a black, thick fluid, much like coal-tar in appearance and odor. It does not dissolve in water, but forms, when added to it up to 12 per cent., a nearly homogeneous emulsion. The weaker solutions are almost milk-colored; the stronger look like coffee mixed with much milk. It was first brought on the market by a manufacturer named Pearson in Hamburg, Germany. When it is mixed with hot water it leaves, even when well stirred, small black specks which sink to the bottom of the vessel. In order to obtain a good emulsion it should first be mixed with cold water, to which later hot water may be added without causing any precipitation. The creolin should be added to the water, not water poured on creolin, as by the first process a better mixture is obtained. A small amount of creolin dropped into water forms a milky cloud. Experiments with different microbes have proved it to possess very high antiseptic power. It ranks as second only to bichloride of mercury, and is much more efficacious than carbolic acid. Eisenberg[1] found that a 3 per cent. solution kills all germs in one minute, and a 5 per cent. solution kills all in ten seconds, the shortest time in which it is possible to make the experiment. It has great hemostatic power, and does not irritate wounds when used in emulsions of ½ to 2 per cent. It is not convenient to have instruments lying in it during operations, since they cannot be seen, and become somewhat slippery. On the other hand, this quality of making slippery is, in my opinion, one of its great claims in obstetric practice. I was most agreeably surprised in a case of turning to feel my hand slip through the vagina and cervix with a hitherto unknown facility after a vaginal douche of 2 per cent. had been given. In this respect its effect is just opposite to that of bichloride of mercury, which has a strong astringent power. As its chief advantage it has been claimed that it should be entirely innocuous to man. This dogma was especially founded on the fact that one dog was made to swallow 30 grammes (ʒviiss), and another 50 grammes (ʒxiiss), without any bad effect. Still, a case has already been reported in which it is supposed to have caused death: " After delivery a uterine douche of about two quarts of a 2 per cent. creolin solution was given to a healthy primipara of twenty-seven. On the following day a douche of a quart of 1 per cent. creolin solution was given, and on the next day a douche morning and evening, the last at half-past six. At nine o'clock she suddenly became pale, cold, and vomited: the vomiting did not cease; perspiration supervened, and the patient died at eleven o'clock in collapse and unconscious, with a temperature of 96.7° Fahr. The vomitus had a strong odor of creolin, and also the urine found in the bladder after death. Five hours before her death the patient was well and strong."[1]

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[1] Eisenberg: *Wiener med. Wochenschrift*, 1888, p. 564.

It would be a sad disappointment if this case should be followed by similar ones, showing that death in it was not due to an idiosyncrasy of the patient.

During the last six weeks I have used a 2 per cent. solution in the Maternity Hospital, instead of bichloride of mercury, for all vaginal and intra-uterine douches. Intra-uterine injections of one to two quarts have been used on 21 patients for post-partum hemorrhage, after removal of retained membranes, turning, expulsion of meconium into into the uterine cavity, or the delivery of a macerated fœtus. Vaginal douches have been used after labor on 17 patients on account of the performance of the low-forceps operation or perineorrhaphy. Vaginal douches, as preparatory treatment before labor, have been used in 47 cases.

So far, I am well pleased with creolin. The smell is by far not so disagreeable and tenacious as that of carbolic acid. It is pleasant to the touch, and does not affect either skin or nerves. Some patients have, however, complained that it smarted. I used it in one case of puerperal diphtheria, but cannot recommend it under those circumstances, because the grayish color of the fluid prevents one from judging of the condition of the inside of the womb by seeing secretions or shreds. I substituted carbolic acid, which shares with creolin the fault of covering by its own odor that of the secretions, but allows one to see what is washed out from the uterus.

Until we find a safe and reliable antiseptic that can replace corrosive sublimate, I think the best we can do is to continue to use it for the disinfection of ourselves, of the outer parts of the patient, and of substances that come in contact with her, and to substitute creolin or carbolic acid for vaginal and intra-uterine injections.

Antiseptic Conduct of Labor.—In another part of this work are found rules for what briefly may be designated as the obstetric part of the conduct of labor,[2] by which term I wish to designate all that the accoucheur was taught to attend to before the era of antiseptic midwifery began. Here we have only to give the necessary supplement consisting of a plan how to do all that in an aseptic and antiseptic way. We have just seen (p. 334 *et seq.*) how doctors and nurses disinfect themselves, and how instruments and other objects coming in contact with the patient are disinfected. We will now examine what other points have to be considered.

Even with the best antiseptic solutions and with all possible care it must be borne in mind that every time a vaginal examination is made we expose the patient to the danger of infection by germs either adhering to the examining finger, or floating in the air, or concealed in some fold of the vagina where they may have escaped destruction by the preliminary douche. It is therefore desirable that these examinations be made as seldom as possible. As our training-school is only destined for nurses, and does by no means aim at the production of midwives, we do not allow the nurses to make any vaginal examinations, except the one who has charge of the waiting ward, and whose duty it is to notify the house staff of beginning labor, and the head-nurse in the pavilion in which the delivery-room is situated. Even these two nurses and the doctors are ordered not to repeat the examinations oftener than necessary for their guidance in performing their respective duties.

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[1] *Therapeutische Monatshefte*, October, 1888; *Am. Journ. Med. Sci.*, Feb., 1889, p. 172.
[2] Vol. I. pp. 493–513.

Another point of still greater importance is not to introduce the examining finger more deeply than necessary. All that is needed in ordinary cases is to examine the presentation and the degree of dilatation of the external os.[1] This ought to be done without entering the womb at all. It may be gratifying for the ambitious young doctor to make out the position too at an early stage, but he ought to abstain from such an investigation if it involve a deeper examination than can be made without going beyond the os. By combining abdominal palpation with the vaginal examination he will obtain further information, and by waiting until labor progresses farther he will in course of time be able to recognize all facts necessary for the proper conduct of the case, without exposing his patient to an unnecessary danger.

Lubricants, such as soap, oil, fat, glycerin, etc., are unnecessary and dangerous. Even 10 per cent. carbolized oil has hardly any antiseptic value. The fluid that adheres to the finger when we dip the hand into the solution of bichloride the last moment before entering the vagina is all that is needed. The same applies to the forceps and other instruments in regard to carbolized water. The only purpose for which I find a lubricant necessary is the introduction of the whole hand into the vagina or womb. Then I use glycerin with 3 per cent. carbolic acid, or, still better, mollin with 5 per cent. Mollin looks much like lard; it softens while being rubbed on the skin, makes the latter more slippery than any substance I know of, and comes off much more easily than lard by washing in water.

In protracted cases the vaginal injections are repeated about every three hours. The more frequently examinations are made, the oftener these injections become necessary; but as these affect the epithelium, which may even be cast off, they ought to be used as rarely as possible.

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[1] The pelvis is examined and measured at the time of admission, which mostly takes place long before labor sets in.

When the presenting part appears at the vulva a piece of lint wrung out of bichloride (1 : 2000) is applied to the latter. It serves partly to prevent a too free access of air to the genital tract when the fœtus moves to and fro, advancing and receding with the contractions of the uterus and their intermissions; and partly it makes all manipulations for the protection of the perineum, such as pushing the head back into the genital canal or pressing the occiput against the pubic arch, much easier by taking away the slipperiness of the presenting part.

Removal of the After-birth.—After the child is born not even a finger ought to be introduced into the vagina in normal cases. During the passage of the child the genital tract is enormously distended, and sustains numerous abrasions and tears, all of which are wide-opened doors for the admission of septic germs. In my opinion, it is of little importance, and not even desirable, to remove the after-birth within a few minutes after the delivery of the child, as taught by Credé.[1] Such an early removal leads to retention of the membranes and post-partum hemorrhage. I seldom remove the placenta in less than fifteen minutes after the birth of the child. In my estimation, the chief merit of Credé's method is the point that the placenta is expelled by pressure from above, and that neither cord nor placenta is touched inside of the body of the woman. I use always both hands for the expression, placing the eight fingers as far down behind the uterus as possible, and the two thumbs in front. The chief movement is one of squeezing, the thumbs and fingers being pressed against one another; but this is combined with another movement, by which the uterus is pushed in the direction of the hollow of the sacrum.[2] With very few exceptions the placenta will roll out of the vulva and sink down on the couch between the thighs. Sometimes the whole ovum comes out in this way, but in most cases it is necessary to help the membranes out, which act ought to be done with the greatest deliberation and gentleness. As I have convinced myself in three Cæsarean sections, the thin elastic membranes adhere to the inner side of the uterus when it contracts and throws off the thick placenta, and have to be peeled off cautiously. This is best done by turning the placenta slowly, so as to form a rope of the membranes, which is seized between the index and middle fingers placed transversely in front of the vulva, and extracted very carefully, alternating with the fingers of both hands. If, on inspection, we find that any part of the placenta has been torn off and remained in the uterus, the well-disinfected hand must be introduced into the womb, the inside scraped with the finger-nails, and all remnants of the ovum removed; after which the uterus is washed out with antiseptic fluid. The danger of infection from any part of the placenta left behind is so great that that of removing it, provided it be done with full antiseptic precautions, is comparatively very small.

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[1] The average time in 2000 deliveries was four and a half minutes (Credé in *Archiv für Gynäkologie*, 1881, vol. xvii. p. 279).

[2] In a special paper on this subject, published in the *American Journal of Obstetrics*, vol. xvii. No. 5, 1884, I have shown how unjust it is when some of Credé's own countrymen have impugned his originality and pretended that his method was the same as the so-called Dublin method. The most authorized interpreters of that school speak of putting the cord on the stretch, hooking the fingers into rugosities formed by the umbilical vessels, and drawing on the funis—things which are all against the spirit of antiseptic midwifery.

If part of the membranes are retained, opinions differ. Some good authorities leave them to be expelled with the lochial discharge, but, having seen both post-partum hemorrhage and septicæmia follow when they were allowed to remain in the uterus, and, on the other hand, never having had any trouble from the introduction of the hand into the uterus, I invariably search this organ for shreds when parts of the membranes have been torn off. In judging if this has happened or not, their great elasticity must be borne in mind, in consequence of which they appear much smaller than they must have been when they contained the child and the liquor amnii.

Intra-uterine Injections are used in every case in which it has been necessary to introduce the finger, the hand, or instruments into the interior of the womb, and in cases of stillbirth when the child is macerated and the liquor amnii looks or smells badly. In order to avoid the possibility of the fluid going by gravitation through a dilated tube into the peritoneal cavity, the patient should lie on her back. A bed-pan is pushed in under her buttocks. A glass tube twelve inches long, curved like a male catheter, with an opening at the end and several others on the sides near the end, is connected with the tubing of the fountain syringe and introduced into the uterus between the middle and index fingers of the left hand held in the cervical canal. Before entering the uterus the vagina should be washed out and the flow kept up during the introduction of the tube into the womb. Sometimes a little resistance is met with, and then the accoucheur should draw the tube back and try in another direction. By failing to do so one of my assistants perforated the posterior wall of the cervix. The tube entered the peritoneal cavity just above the junction between the cervix and the body of the uterus. The usual injection of a quart of bichloride (1 : 4000) was given, the patient collapsed, and died in six hours. The autopsy showed beginning peritonitis.

Before introducing the tube the obstetrician should measure how far it has to go in in order to reach the fundus; he should ascertain that it goes in the direction of this part; he should feel the resistance with which it meets in touching the fundus; and he will often even be able to feel the point of the tube through the abdominal wall. By paying attention to all these details such a deplorable accident would have been avoided.

For years we have been using for the intra-uterine injections a 1 : 4000 solution of bichloride of mercury, but, as stated above, I think it is safer to take creolin (2 per cent.) or carbolic acid (2 per cent.). The amount need rarely exceed one quart. The fountain jar should not be held more than a foot above the fundus uteri. The fluid should be so hot that the hand can just be kept in it (110°-115° Fahr.). This causes considerable pain, but is necessary in cases of post-partum hemorrhage, and immediately after delivery it is wise to use such hot water, even if there is no hemorrhage, in order to prevent it. The hot water is a powerful stimulant for the uterus which nearly always insures contraction. I have never seen thrombi torn off by introducing the tube up to the fundus, and only to introduce it as far as the internal os, as advised by some, does not insure a thorough disinfection of the whole cavity. The cervix is so large that the water easily finds an outlet. Catheters with double current are therefore not necessary. Most of them are hard to keep clean, and sometimes the water may flow from the narrow afferent tube to the wide efferent tube without filling the cavity in which the catheter is held; not to speak of the danger if by mistake connection is made between the wide tube and the fountain syringe. In this way one of my assistants ruptured a uterus that was already thinned by the loss of substance caused by dissecting metritis.

After the injection the fluid should be squeezed out from the uterus and removed from the vagina by turning the patient on her side.

Dressing.—After the removal of the after-birth the patient is again washed with bichloride (1 : 2000). For the vulva I prefer pledgets of absorbent cotton; for the skin clean muslin rags are more convenient. I take care to remove the clotted blood with which the pubes are matted together. If the hairs be long and fine, this procedure is shortened considerably by cutting part of them off, together with the adherent blood. As there frequently comes a little gush of blood some time after the removal of the placenta, and it is annoying both for patient and doctor to do the work over again, I think it is good policy not to begin the cleaning too soon. In the Maternity Hospital it is even the rule to compress the uterus with the hand for half an hour before the binder is put on.

To the latter is fastened an antiseptic occlusion bandage (Fig. 100, 3), consisting of (1) a piece of lint, twelve by eight inches, folded twice lengthwise, so as to be three inches wide, the average distance from one genito-femoral sulcus to the other; (2) a piece of oiled muslin, four inches wide and nine long; (3) a large pad of cotton batting; and (4) a piece of muslin, half a yard square. The lint is wrung out of the solution of bichloride (1 : 2000) and carefully applied over the vulva and the anus. The oiled muslin is washed with the same solution and placed over the lint, turning the edges forward against the inside of the thighs. These two constitute the antiseptic part of the dressing. The pad of cotton outside serves only to keep the compress in apposition to the entrance of the genital canal, and is itself held by the muslin kerchief, which is folded like a cravat and fastened to the binder with four pins in front and two behind. A good binder should go down beyond the trochanters, and a Λ-shaped opening left at the genitals, which is closed by the pad just described, as seen in the figure. This dressing is changed every six hours, or oftener if the patient has a movement or passes her urine in the mean time. Before the fresh dressing is applied the genitals and nearest parts are irrigated with bichloride (1 : 2000), the patient lying on a bed-pan. No injection is given; nay, the genitals are not touched.

Some think this way of dressing the genitals after delivery is superfluous; and it must be admitted that excellent results are obtained without it. Still, much may be said in favor of it. In the first place, people are accustomed to cover the genitals in some way with napkins, rags, or compresses, but anything not specially prepared, so as to be aseptic, that is brought in contact with the genitals of a puerpera constitutes a positive danger of infection. If the antiseptic pad is not used, it is much better to desist from any kind of cover. Secondly, I think this occlusion bandage is entirely rational. We have to do with wounded tissues, and we cover them with an antiseptic dressing, just as we do a wound caused by an operation or by injury. Under all other circumstances the "open" wound treatment has been superseded by the occlusion dressing and by the antiseptic dressing. Why should we not give the parturient canal the same advantages? As I believe that puerperal fever may be acquired by germs floating in the air and entering the genital canal, it is a precaution to close its entrance. By my pads air is virtually kept out or so filtered that it becomes sterilized. Even to those who do not admit infection through the air the pad ought to recommend itself by keeping out of the way those "solid bits of dirt" to which Mr. Lister has called attention as constituting the chief danger to wounds. Soft and warm, it is very pleasant to the patient. It keeps the air in the wards entirely free from odor. It has a favorable influence on both patient and nurse. The former, especially if she has gone through a confinement before, or if she hears from friends that nobody took so much trouble with them when they were confined, feels that she is being taken particularly good care of; the latter is reminded of the great truth that the rima pudendi is the chief entrance for agents that may jeopardize the life of her patient and cause herself considerable trouble.

The pad does not favor the retention of lochia and the formation of clots in the genital canal. Quite the contrary: its inner layers being formed of a highly porous substance, a continuous suction is going on through its thousands of capillaries, and the result is that the formation of a clot is a very rare occurrence; in fact, much more so than if the genitals are left unprotected or only covered with a napkin.

The bichloride imparts a whitish color to the skin and a bright-red color to blood. Wounds become often covered with a thin, sulphur-colored layer of inspissated pus, which the beginner must be careful not to confound with the patches found in puerperal diphtheria. In exceptional cases the pad causes a little smarting or even a slight eczema, easily remedied by painting the part with glycerin before applying the pad.

Ergot.—As a good contraction of the uterus is a great protection against puerperal infection, the use of ergot deserves to be mentioned in this connection. Having seen how difficult it may be after the administration of this drug to enter through the internal os if such a manipulation becomes necessary in order to remove the whole or parts of the after-birth or arrest hemorrhage, I never use it before the uterus is entirely empty, but then I give a teaspoonful of the fluid extract. If there is a rather free flow, I give half a fluiddrachm every three hours, and in all cases I give this amount three times a day, as a rule, until an ounce has been used in all.

Perineorrhaphy.—Every primipara sustains a tear at the posterior part of the entrance to the vagina,[1] the circular opening forming the limit between the vulva and the vagina, while the skin between the anus and the vulva forming part of the boundary of a much larger opening escapes in many cases. The internal wounds are, as a rule, not treated. At one time I tried it, but found that it gave rise to retention of lochia and wound-infection. That was, however, before the introduction of strict antisepsis. If the tear extends from the entrance of the vagina to that of the vulva, the rima pudendi, the commonly so-called laceration of the perineum, preventive antiseptic treatment, apart from gynecological considerations, demands an immediate repair. A tampon of cotton wrung out of a solution of creolin or carbolic acid (2 per cent.), to which a string is attached, is introduced into the vagina above the upper limit of the tear. Thus the bloody discharge from above is kept away from the wound while it is being sutured. Shreds that hang only by a pedicle are cut off, the wound is irrigated with one of the named solutions, the sutures, either silver or aseptic catgut or silk, are inserted, the surface is again irrigated, dusted with iodoform, and the sutures closed.

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[1] J. Mathews Duncan: *Papers on the Female Perineum*, London, 1879, p. 8.

Catheterization.—The old way of drawing the urine under the bedclothes was modest, but is irreconcilable with antiseptic midwifery. By carrying mucus from the vulva into the bladder we are apt to cause cystitis. The parts must be exposed, and the surroundings of the meatus carefully wiped with absorbent cotton wrung out of bichloride or another disinfectant solution, before introducing the catheter. In hospitals only metal catheters ought to be used, as elastic and soft-rubber catheters are more or less absorbent and cannot be kept sufficiently aseptic. If the expense of silver catheters is objectionable, those of nickel-plated metal, costing fifty cents, are quite as good. They ought to be kept in glass jars filled with carbolized water (5 per cent.), but as this is much too strong for the urethra, they ought to be rinsed with plain lukewarm water immediately before using them.

Syringes.—In preantiseptic times the nozzles of syringes were doubtless often the carriers of poison from patient to patient and the true cause of so-called epidemics. This is easily avoided by having fountain syringes and a sufficient number of glass nozzles—one for the rectum and another for the vagina—so that the same tube is only used for one patient during her lying-in period. When she leaves the tubes may be destroyed or disinfected by boiling them in a solution of bichloride 1 : 1000. If they have been used in a patient suffering from puerperal infection, the tubes ought always to be destroyed.

Cost of the Antiseptic Treatment.—Even regarded from the standpoint of economy, the antiseptic treatment recommends itself. Before its introduction we used enormous amounts of quinine and whiskey. Now our consumption of these expensive drugs has become so insignificant that the hospital, in spite of the new expenses caused by the antiseptic treatment, is run at much smaller expense than formerly.[1] The four dressings for each patient in the Maternity Hospital cost about ten cents a day, which averages about one dollar for the whole lying-in period. The corrosive sublimate costs only sixty-five cents per pound, creolin sixty cents, and carbolic acid in crystals fifty cents.

II. PREVENTION OF PUERPERAL INFECTION IN PRIVATE PRACTICE.

While the principles of antiseptic midwifery are now followed in the lying-in hospitals of all civilized countries, and while in those countries in which private confinements are mostly in the hands of midwives, such as Germany and Denmark, the latter are bound by governmental regulations to conduct the labors they take care of antiseptically, antiseptic prophylaxis in private midwifery practice is yet in its infancy in this country. I am convinced that among the numerous midwives practising in New York it is hardly employed at all, and that even among doctors only a minority use it in midwifery practice.

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[1] Oiled muslin may be bought of W. B. Lawrence, 96 Spring St., for $1.65 per roll, each roll containing five yards and being one yard wide; absorbent lint of Seabury & Johnson, 21 Platt St., for 52 cents per pound, a pound package measuring seven and one-third yards in length and eighteen inches in width; and absorbent cotton of the same firm, for 48 to 52 cents a pound, according to the quantity taken at a time.

I wish it were possible to find statistics showing the mortality of childbed in New York City outside of the hospitals; but in the way deaths and births are now registered they would be of little value and could only be obtained at great expense. We must therefore try by other methods to get an idea of what the mortality of childbirth and childbed in private practice may be.

The following list[1] shows the results obtained by some prominent obstetricians in Great Britain and Ireland:

	Deliveries.	Deaths.
M. Duncan	736	7 = 1 in 105.
McClintock	652	6 = 1 in 108.
J. Clarke	3,847	22 = 1 in 175.
Crosse	1,377	14 = 1 in 98.
Labatt	4,368	26 = 1 in 168.
"A London accoucheur"	2,982	30 = 1 in 99.
Brunker	334	6 = 1 in 56.
Churchill	2,548	16 = 1 in 159
"A physician"	10,190	107 = 1 in 95.
T. E. Beatty	2,064	19 = 1 in 121.
Total,	29,098	251 = 1 in 116, or 0.86 per cent.

All these patients were from the upper or middle ranks of society. If among this favored class and in the practice of the most skilful obstetricians the mortality due to childbirth amounts to 1 in 116, we can imagine how much greater it is when the figures comprise on one hand all general practitioners and ignorant midwives of a large city, and on the other the whole population, down to the poorest and most abject woman giving birth to a child on a dirty bed in a crowded tenement-house.

But we need not draw alone on our imagination. We can come very near the actual number of deaths in another city. In Copenhagen, the capital of Denmark, 108,737 women were delivered during the twenty-five years from 1850–74. Of these, 885 died of "puerperal fever"—*i. e.* 1 in 123—and while the number of confinements is entirely reliable, that representing the deaths is too small. The term "puerperal fever" was then—and is in some degree now—used in a very restricted sense. There is no doubt that many deaths that properly were due to puerperal fever were registered under other headings, such as peritonitis, metritis, hepatitis, nephritis, phlebitis, etc. The ratio 1 : 123 is consequently too small, even if we speak of puerperal fever alone; and if we add the mortality in childbirth and childbed from other causes than puerperal fever, the proportion of deaths to confinements will be a much larger one. Since the beginning of the year 1873 all deaths connected with parturition and the puerperal state are registered under two headings, one of puerperal fever, and one of all other causes except puerperal fever:

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[1] Mathews Duncan: *Mortality of Childbed and Maternity Hospitals*, Edinburgh, 1871, pp. 22, 23.

Year.	Deaths from Puerperal Fever.	Deaths in Childbirth and Childbed excepting Puerperal Fever.[1]
1873	45	17
1874	38	21
1875	44	17
1877	42	13
1878	58	8
1879	31	20
1880	31	18
1881	43	12
Total	332	126

These data are for the whole city, inclusive of the lying-in hospital. If we now take these figures as a basis, and suppose that the deaths caused by childbirth and the puerperal state, exclusive of puerperal fever, be proportionally divided between the lying-in hospital and the rest of the city, we would have to add 336 to the above 885 deaths, which makes 1221, and this divided into 108,737, the total number of deliveries, is 89. 1 *in* 89, *or* 1.12 *per cent., would then be the mortality of childbirth and childbed in private practice in a large city.*[2]

By computation we can find that it is, to say the least, not much less in the city of New York. Lusk[3] found the number of deaths from diseases complicating pregnancy, from the accidents of childbirth, or from diseases of the puerperal state in this city, from 1867 to 1875, to be 3342. The number of births being unknown, it is estimated to be 284,210.[4] From the 3342 deaths have to be deducted 420 that occurred in hospitals, which leaves 2922 for the city. This, divided into the number of confinements, would be equal to 1 in 97; but this mortality is evidently too low, since we ought to deduct all the confinements that took place in hospitals. This I have no means of finding, but I will at least collect the figures, as far as they have been accessible,[1] of women who were confined in hospitals during any part of the nine years examined by Lusk:

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[1] Official reports published in *Ugeskrift fur Læger.* I have no means of consulting the later volumes of this journal.

[2] Copenhagen has now about 300,000 inhabitants, but at the period referred to the population ranged from 150,000 to 200,000.

[3] W. T. Lusk: "On the Nature, Origin, and Prevention of Puerperal Fever," *Trans. of the International Medical Congress*, Philadelphia, 1876, reprint, p. 3.

[4] This number is arrived at in the following way: The census of the year 1870 gives to New York a population of 942,292. The average increase from 1860 to 1870 was 15,000. The same increase is supposed to have taken place during the following five years. The births are estimated to be 33 in 1000—an estimate which errs on the side of liberality.

Lying-in Asylum, 85 Marion St.	1867–75	719	deliveries.
Infant Asylum	1872–75	317	"
Infirmary for Women and Children	1867–75	703	"
Nursery and Child's Hospital	1867–75	1333	"
Charity Hospital	1874–75	896	"
Emigrant Hospital	1868–75	3189	"
Bellevue	1873–74 (1st half)	615	"
	Total,	7772	

To these 7772 ought to be added the number of births that occurred in Bellevue from 1867 to 1872 and in the Emigrant Hospital during 1867; but as the records are not to be found, we must satisfy ourselves with an estimate; and, according to the above figures, we do not risk to err much by supposing that there were on an average at least 400 women a year confined in each place. This would give 2800 additional births to be deducted from the city's account.

Thus, from the number of 284,000 births we have to deduct 10,572 which took place in hospitals. We find, then, that to the charge of the city of New York outside the hospitals should be assigned 273,428 births, with 2922 deaths, or 1 in 94, or 1.06 per cent.

If these figures, 1 in 89 or 1 in 94, are not absolutely exact, and are only found by computation, they are computed in a way that makes the mortality in the city rather appear too small than too large. So much is sure: that out of every 100 women who give birth to a child in a private house in New York, 1 dies during or shortly after labor.

The same applies to the Maternity Hospital, but when we take into consideration that nearly one-half of our patients are primiparæ, that they all are poor, that many of them are ruined by drink and debauchery, and that the hospital by its intimate connection with a general hospital presents peculiar dangers which cannot be entirely overcome, private practice, with its large proportion of wealthy, pure, and healthy parturient women, and its great preponderance of multiparæ, ought to obtain better results than the hospital.

I have no doubt that this will be so when our physicians generally adopt antiseptic midwifery. An old physician with a large practice has told me that he used to have a case of puerperal infection every month, but during the last five years, since he adopted the treatment described by me,[1] he has been entirely free. I wish these lines may engage many to follow his example.

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[1] Garrigues: "On Lying-in Institutions, especially those of New York," *Trans. Am. Gyn. Soc.*, vol. ii., 1878, p. 646.

Honorable physicians object to the use of antiseptics in midwifery cases in private practice because they deem them superfluous. They say that they have kept record of their cases since they started as practitioners, have had five or six hundred confinements, and have never lost a patient. To this I can only answer that the number is yet too small to draw a general conclusion from it, that general statistics show that to such a number of confinements correspond half a dozen deaths, and that they may expect their turn of trouble. Besides, mortality is not the only thing to be taken into consideration. The question is, How many of these patients have been more or less sick during their lying-in period? Perhaps much pain, anxiety, and expense might have been avoided by following the prophylaxis recommended in these pages.

Others say that they are busy practitioners, that the preparation of antiseptics takes time, and that they have to be satisfied with so low a fee for their obstetric work that they cannot afford to spend so much time on it. This point is well taken, but I believe that in the long run these physicians will find it to their advantage to adopt at least part of the antiseptic preventions. If they fail to do so, they cannot avoid getting septic cases. These take much time to treat; the result is very doubtful; and the patient and her friends are very likely to throw the blame for the undesirable occurrence on the physician; which may hurt his interests. He risks to carry infection from this case to others. He may even be obliged to give up midwifery practice for a time, and thus his loss will be much greater than if he devoted a quarter of an hour to disinfection.

Others, again, say their patients do not want to be bothered with all these precautions against a danger which they do not see and the scope of which they do not realize. Nor do they care to go to the extra expense entailed by buying the necessary materials for the antiseptic treatment. They have no trained nurses, but have to be satisfied with the services of a relative, friend, or untrained hired person. We will presently see that the antiseptic treatment may be so simplified that any person with average intelligence can carry it out, that it costs very little or nothing, and that it gives so great comfort to the patient that, even apart from all considerations of safety, she is amply rewarded for the small inconvenience of being disinfected.

Country practitioners are still more averse to antiseptic prophylaxis than their confrères in the cities. They insist, with good reason, on the purity of country air and the robust constitutions of their patients; but if these circumstances give them better chances of recovery when sick, they cannot prevent them from being infected. In some respects the dangers for the parturient woman are even greater in the country than in the city. Everybody who has paid attention to it knows how difficult it is to dispose of all refuse, dirt, and excremental substances in the country. Manure, that is a mixture of feces and rotting vegetable substances, is spread over the fields. A butcher kills his animal, lets the blood soak into the ground, and hangs the skin up to dry on a hedge, where it can be smelt at a long distance. The peculiarities inherent to country practice expose the patient more to infection by her accoucheur than in the city. The long distances prevent him from going home and changing his clothes when he has seen a case of puerperal fever or any other disease that may give rise to it, or performed an autopsy. He has to take the cases in the order they come, and the same fingers that a little while ago were bathed in the foul pus of a perineal abscess, performed tracheotomy for diphtheritic croup, or dressed a patient with erysipelas have now to be introduced up to the fundus of the uterus and peel off an adherent placenta.

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[1] *Medical Record*, Dec. 29, 1883.

The mortality from puerperal causes may even be very high in country practice, as shown in the following instance: Sprachbrucken, a little village near Darmstadt in Germany, had during five consecutive years the following puerperal mortality, viz.: in 1860, 18 women were confined, 1 of whom died; in 1861 there were 26 confinements, with 4 deaths; in 1862, 29 confinements, again 4 deaths; in 1863, 24 deliveries, with 3 deaths; in 1864, 25 deliveries, with 1 death—or, in all, 122 women confined, 13 of whom succumbed—a mortality of 10.6 per cent.,[1] which is much worse than it ever was in the Maternity Hospital.

There is, therefore, just as much, if not more, call for antiseptic prevention in midwifery in country practice as in city practice.

In wealthy private practice I carry out the treatment as described above for the hospital, with very few modifications. Where several rooms are at our disposal we ought to choose a large, airy, light, and preferably sunny one. It ought to be as far away from the water-closet as possible. If it is adjoining to the bathroom, the door ought to be kept closed, and some of Platt's chlorides or another powerful disinfectant should frequently be poured into the water-closet. Even a washstand with running water, and consequent connection with the sewer, is not without danger.

Instead of lint I use for covering the genitals a pad of absorbent cotton, finger thick and otherwise of the proportions stated above.[2]

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[1] Hegar: *Die Sterblichkeit während Schwangerschaft, Geburt. und Wochenbett*, Freiburg im Breisgau, 1868, p. 42.

[2] The so-called sanitas pads used during menstruation by many ladies, and sold for fifty cents a dozen by Mrs. Fletcher, 6 E. Fourteenth street, are very convenient for this purpose.

Instead of oiled muslin I take thick gutta-percha tissue. It is better than oiled silk, and costs just one-third. The dressing is only changed three times a day, morning, afternoon, and evening.

There ought always to be a plentiful supply of the standard solution of bichloride of mercury (1 : 1000), creolin, and carbolic acid, hot and cold water, on hand, so that the accoucheur at any moment can have solutions of different strengths and different temperatures.

He ought likewise to order the patient beforehand to have the necessary vessels in readiness—viz.: two glass quart bottles with corks, two pitchers, and two basins, all of china or a similar non-metallic substance. He had better clean all these utensils himself before using them. The bottles contain the standard solution; the pitchers are for hot and cold water; and the basins for dilute solution of bichloride, creolin, or carbolic acid. One powder of fifteen grains of bichloride or two tablets of seven and six-tenths of one grain, as they are on the market, dissolved in a quart of water, form the strong solution of 1 : 1000. Bichloride is easily dissolved in hot water, and still more so in alcohol, one of which ought to be used before cold water is added. Carbolic acid mixes likewise more easily with hot water than with cold; the mixture ought to be stirred until every trace of the oily drops has disappeared by being dissolved in the water. Creolin mixes very easily with water, forming a milky emulsion.

Where economy is necessary this treatment may be much simplified. For the pad common cotton batting may be used instead of absorbent cotton, and then the gutta-percha tissue may be dispensed with. Nay, we may even give up the occlusion dressing altogether. Thus, in its most reduced shape the preventive antiseptic treatment consists only in the disinfection of the patient, the accoucheur, and his instruments, and many physicians carry corrosive sublimate, in substance or alcoholic solution, and carbolic acid, in their satchels, so that the patient does not incur any extra expense whatsoever by the antiseptic treatment; and they might add an ounce of creolin. But whenever possible I would recommend to let a solution of bichloride run over the surroundings of the genitals three times a day. A bed-pan may be replaced by a flat tin basin, which only costs a trifle.

For vaginal injections the nozzle of hard rubber or even metal which accompanies most syringes will do. Intra-uterine injections may be given through so-called "soft-metal" catheters, that are cheap and present the advantage over glass of being flexible, which allows their being used in abortion cases. A new English catheter, about No. 10 or 11, is likewise good, provided it never be used in another case. The uterine sound used as a stylet facilitates its introduction very much.

Reduced to its lowest degree of simplicity, the antiseptic treatment is really so simple that it can be carried out under all circumstances, and in my opinion the practitioner who loses a patient in childbed without having used even these most simple and elementary precautions cannot be said to have performed his whole duty toward his patient and to be free from any responsibility for her death.

If the treatment even takes a little more time or costs the physician a few cents, he has, on the other hand, the advantage that no kind of disease in his practice prevents him from attending to midwifery cases. If for no other reason, he ought to use antiseptics out of consideration for the consultant physician whom perhaps later he has to call in to help him. How often does it not happen that patient and doctor in the beginning of labor do not anticipate any trouble, and that later operations become necessary which the first incumbent does not feel competent to perform! And the prognosis of any kind of operative interference—nay, even the choice of the operation—*e. g.* between the improved classic Cæsarean operation with its comparatively good prognosis and Porro's operation by which 50 per cent. die, depends to a great extent on the use or neglect of true antiseptic precautions.

III. CURATIVE TREATMENT OF PUERPERAL INFECTION.

Formerly, a great many methods and remedies were used in the treatment of puerperal infection. Acting under the impression that a deleterious fluid was circulating through the body, every means was used to eliminate it. The patient was bled, salivated, made to vomit, and purged. Counter-irritation was used in the shape of large blisters. The tympanitis was combated with layers of collodium. Salivation and emetics have been entirely discarded as worse than useless. General bloodletting from the arm has followed them. Local abstraction of blood by means of leeches or cupping is hardly used in this country. The purgative method has been relegated within very narrow limits. All that remains of it is the emptying of a full intestine, and in most cases we prefer to reach this end by means of enemas. Large blisters covering the whole abdomen are never used nowadays. Smaller ones may yet be applied by some practitioners to combat cellulitis. I never use them. The painting of the swollen abdomen with collodium only increased the pain, and could, of course, not exercise any salutary influence on the disease itself.

As the patient is in a more or less weak condition by having recently gone through the pains of labor and from loss of blood, and as the infection tends to prostration of the vital forces, we should carefully avoid any kind of treatment that may weaken her either by abstraction of constituent parts of her organism or by depression of her nerve-power.

Since we know that in the vast majority of cases the disease is due to the entrance of microbes through the wounds of the genital canal, a double indication presents itself at a glance: first, to close the gate in the face of the enemies that are yet outside; and, secondly, to throw those out which have already gained access to the fortress. The first of these indications is met by washing the vulva, the vagina, and the uterus with an antiseptic fluid, and by sealing the openings of the veins, lymphatics, and the interstices between the bundles of connective tissue by means of cauterization. The second can only be met by general treatment; and in this respect we can hardly do more than to sustain the vital forces while the system frees itself from the microbes and the poison engendered by them.

No birth takes place without tears or abrasions of the genital tract; but if the labor has been conducted according to the principles laid down in the preceding pages, these wounds are in an aseptic condition, and are kept so until they are healed or granulation is far enough advanced to place a powerful barrier in the way of infection. Minor wounds do not call for any treatment besides the application of the antiseptic pad described above. Larger tears are almost exclusively found in or in connection with the perineum, but their repair is considered in other places.

In the following I shall try to describe in detail the way of treating puerperal infection. For clearness' sake I divide the subject according to the parts affected, but the reader must bear in mind that it is all one and the same disease, only differentiated by the intensity of the infection or the peculiar structure and function of the part in which localization takes place. A method of treatment which is discussed under the heading of the condition in which it is mostly used may therefore be as well applicable when other organs are so prominently affected that their names are used for a new heading. When, for instance, antipyretics are discussed under Peritonitis, what is said there applies, of course, whenever the object is to reduce the temperature, whether the peritoneum is inflamed or not.

Sometimes the lochia become fetid, or there may be a moderate rise in the temperature, below 102° Fahr., acceleration of the pulse and the respiration, and yet no tenderness found anywhere, nor any abnormality detected by means of the speculum. This condition is probably due to a very mild degree of infection, sometimes connected with the presence of a clot in the uterus or the vagina, and is, as a rule, remedied by the administration of vaginal injections every three hours, five grains of quinine three or four times a day, and an aperient.

Vulvitis and Vaginitis.—The catarrhal inflammation calls only for vaginal injections with creolin or carbolic acid (2 per cent.), three times a day. Simple ulcers may besides be dusted with iodoform or covered with iodoform ointment. (℞. Iodoformi, ʒj; Bals. peruv. ʒij; Vaselinæ, ℥j).

If the sores in the vulva and vagina become diphtheritic, I touch them with a solution of chloride of zinc in equal parts of distilled water, which is applied by means of absorbent cotton wound round the end of a wooden stick. In private practice such sticks are easily obtained from the nearest butcher-shop, where they are used as pins to keep the meat together, or penholders or lead-pencils may be used. The caustic ought to be kept in contact with the wound for a minute. After that the vagina is thoroughly syringed with some reliable and safe antiseptic fluid, such as creolin, carbolic acid, acetic acid, or hydronaphthol—not bichloride of mercury, for reasons given in treating of the prophylaxis.

If the perineum has been stitched, the sutures must be removed, for the wound is either already infected or will soon be so. The sores in the deeper part of the vagina can only be reached when the parts are exposed with a speculum. If the surfaces to be touched are not very small, it is advisable to anæsthetize the patient, as the application is rather painful. After the cauterization the parts are dressed in the usual way.

The vagina ought to be syringed every three hours, and examined once in twenty-four hours for new patches. If any are found, the same procedure is gone through again.

The first effect of the chloride of zinc is to bring the diphtheritic infiltration out much more distinctly, as it assumes a nearly milk-white color. Later, a grayish slough is formed, which is very like the diphtheritic patches. In order to distinguish old cauterized places from new diphtheritic infiltrations the physician must remember where he applies the caustic and pay attention to the outline of the sore. The slough due to cauterization has a plain curved line, while if the diphtheritic inflammation spreads the progress is somewhat uneven on different points, so that the line of demarkation becomes scalloped.

The object of this cauterization with chloride of zinc is both to kill the microbes found on and near the surface of the wound, and to seal all the canals leading from this surface into the interior of the tissues. I have found the chloride of zinc much more effective for this double purpose than tincture of iodine, iodoform, and liquor ferri subsulphatis or perchloridi.

The general treatment consists in the administration of an aperient if the bowels have not moved freely, five grains of quinine four times a day, and some strong alcoholic stimulant, such as whiskey or brandy, half an ounce, a little diluted with water or milk, every two hours. For a change the alcohol may be administered in the shape of egg-nog. If liquor is not well borne, it may be replaced by port wine in a corresponding dose, but, as a rule, large amounts of the strongest drinks can be given in puerperal diphtheria without producing intoxication.

If there is gangrene of the vulva or vagina, the general treatment is essentially the same as that here described, but the use of tonics and stimulants should be pushed somewhat more. The local treatment consists only in injections and dressing with creolin until a line of demarkation is formed. As soon as feasible the dead tissue is removed, and sometimes regeneration may be promoted by the use of iodoform or camphor. (See under "Bed-sores.")

ENDOMETRITIS AND METRITIS.—If subinvolution, tenderness, and the discharge of a dirty, offensive fluid show that the uterus itself is implicated, the first question is whether the uterus is empty or not. If there is any doubt in this respect, the patient should be anæsthetized, placed on her back on a table, the knees held bent by two assistants, the buttocks drawn to the edge of the table, the disinfected hand lubricated with carbolized mollin (5 per cent.) or glycerin (3 per cent.) brought into the vagina, and one or more fingers or the whole hand introduced into the cavity of the uterus. While the other hand, placed on the fundus, steadies the uterus and presses it down against the one in the interior, the internal surface is scraped with the nails. It is a great advantage if we can enter at one end and separate the whole foreign body in one piece, but often this can only be done piecemeal. It is, however, not necessary to remove the hand. By pressing the fingers with the loosened tissue against the hollow of the hand it is made to descend along the arm, and the operator goes on separating the next part.

If the uterus has contracted so much that the hand cannot be introduced, and if we cannot remove all with the fingers alone, a very useful instrument is the large dull wire curette originally introduced in gynecology by Dr. T. G. Thomas. (See SYSTEM OF GYNECOLOGY, Vol. I. Fig. 171.) For obstetric purposes it is fourteen inches long—has a shaft a quarter of an inch thick and an eye admitting the top of the thumb. In using this instrument I place the patient on her left side, the knees drawn well up, and direct an assistant to make counter-pressure on the fundus. This instrument, introduced at the edge of the part to be taken away and carefully moved sideways, has often answered an excellent purpose in my hands as early as the third month of pregnancy, interrupted by abortion. At a still earlier period, when Thomas' curette does not enter, I use Récamier's. Whenever it is possible, at least one finger ought to be introduced, besides Thomas' curette, both to feel the part to be removed and to aid in its removal, the part being seized between the finger and the curette, which is safer than to use either the curette alone or a placental forceps.

When the internal surface feels smooth the patient is turned on her back and an antiseptic intra-uterine douche is given. If there is much bleeding, the injection ought to be hot, as described above. Otherwise, a *lukewarm* solution is preferable if no anæsthetic is used, as the hot water causes great pain when it comes in contact with the raw surfaces. Since creolin has such marked hæmostatic power, the temperature of the water need not be so high if that drug is used.

The uterus being empty and disinfected, it is best in confinement cases to introduce a suppository with iodoform. In abortion cases I do not use any, and have never felt the need of any such medication. In confinement cases these suppositories present the great advantage that the intra-uterine douche need not be repeated so often—as a rule, only once in twenty-four hours. This ought to be continued as long as there is a dirty discharge from the womb, and after every injection a new suppository is put in. As a 2 per cent. creolin emulsion has itself a grayish color, like coffee with much milk, it prevents one from judging of the secretion and small shreds found in the interior of the uterus. In this particular case I prefer, therefore, carbolic acid (2 per cent.). A Cusco's speculum or one of its modifications (see GYNECOLOGY, Vol. I. p. 305, Fig. 117) is introduced: the suppository is seized with a pair of forceps bent as the intra-uterine tube,[1] and introduced up to the fundus of the uterus. In order to be sure of getting into the interior of the body of the womb, the distance from the proximal end of the speculum to the fundus should be measured with the forceps before introducing it. A common dressing-forceps cannot be used for this purpose. It only wounds the womb, and cannot be brought in deep enough. The suppository ought to be so hard that it does not bend. I have found the following composition very good:

℞. Iodoformi,	ʒv;
Amyli,	ʒss;
Glycerinæ,	fl. ʒss;
Acaciæ,	ʒj.

S. Divide in three suppositories of the size and shape of the little finger.[2]

Sometimes it is not necessary to repeat the intra-uterine treatment at all, the general condition being satisfactory. Then vaginal douches are substituted. They are likewise used as a supplement to the intra-uterine injections, and are repeated every three hours.

Involution is promoted by ergot or faradization. The latter ought only to be applied on the outer surface, one pole at the fundus, the other above the symphysis, as the internal application opens the door for new infection.

The inflammation, and especially the tenderness, are combated by placing an ice-bag above the symphysis. Four layers of muslin or two of flannel are inserted between bag and skin in order to avoid local freezing. Ice is preferable to warm poultices, because it soothes the pain more and abridges the course of the disease. It seems even to possess direct antiseptic properties, since, according to experiments, certain microbes only grow at the temperature of the body.[1] Poultices, are, however, to be used when the ice is contraindicated; for instance, by diarrhœa, great debility or low local vitality, as in puerperal diphtheria.

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[1] I have had such forceps made by Hazard & Co. (Ford).

[2] Modified from Ehrendorfer, *Archiv für Gynäkologie*, 1884, vol. xxii. p. 84.

The ice-bag is continued day and night as long as there are considerable pain, tenderness, and fever. When the disease takes a more subacute course I substitute Priessnitz's compress—*i. e.* a towel wrung out of cold water, which is applied to the lower half of the abdomen and covered with some waterproof fabric, under the belly-binder. It is changed four times in twenty-four hours. It gets warm in a few minutes, and this transition from cold to heat is a powerful absorbent.

Internally, five grains of quinine from four to six times a day, small doses of morphine, and a moderate amount of stimulants are given.

If the inspection of the cervical mucous membrane shows *diphtheritic* infiltration, the treatment is more energetic. Then the whole cervical membrane up to the internal os is thoroughly cauterized with chloride of zinc, as described in speaking of the vagina, the uterus washed out with antiseptic fluid, and the iodoform suppository introduced. In this case the intra-uterine injections have always to be repeated, but when the iodoform suppository is used it suffices, as a rule, to do it once a day. Before I used the suppository it was necessary to repeat the injection every few hours. The treatment is kept up until the sloughs come off and the fever ceases.

In puerperal diphtheria I prefer warm poultices to ice-bags, on account of the tendency to disintegration of the tissues. The general weakness calls for much larger doses of alcohol than where the disease is limited to the vulva or vagina. At least half an ounce should be taken every two hours. Digitalis may also be needed as a cardiac tonic. The best preparation has proved to be the infusion of the leaves (ʒss—℥vj, a tablespoonful four times a day). If the patient cannot swallow or rejects medicine from the stomach or a prompt effect is required, the tincture is given hypodermically in doses of five to fifteen minims, and repeated according to circumstances. Tincture of strophantus in five-drop doses is also a valuable heart tonic.

Quinine is only given, as heretofore, in moderate doses, not with a view of reducing the temperature, but as a tonic and antiphlogistic, as one of the properties of this valuable drug is to prevent the emigration of the leucocytes from the veins and capillaries.[2]

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[1] Zweifel: *Archiv für Gynäkologie*, 1885, vol. xxvii. p. 315.

[2] C. Binz: *Grundzüge der Arzneimittellehre*, Berlin, 1874, p. 109.

In *dissecting metritis* there elapses often so long a time before the separated portion of the uterus is expelled that the more energetic but poisonous antisepsic injections are not well borne. In such cases I have with advantage substituted the saturated solution of boric acid, and would now use creolin in a 2 per cent. emulsion. This, like all other fluids used for intra-uterine injections, ought to be warm. At the time when we used a dilute solution of chloride of zinc for intra-uterine injection we had a case of collapse and death following so immediately upon the injection of the cold fluid that a connection between the two could hardly be doubted.

Putrescence of the uterus is a condition that is hardly ever found nowadays: it belongs to preantiseptic times. If a case should come under observation it ought to be treated with intra-uterine douches of creolin frequently repeated, iodoform suppositories, and large and frequent doses of alcohol and quinine.

CELLULITIS AND ADENITIS are treated with the ice-bag, followed by Preissnitz's compress. If a swelling remains after the pain has subsided, I paint the corresponding part of the abdominal wall with tincture of iodine, and when, after a few days, the epidermis has become hard, I cover it with a piece of lint soaked in glycerin and water, equal parts, with 2 per cent. of carbolic acid. The effect of this is to promote absorption and permit an uninterrupted use of the iodine, whereas otherwise the skin cracks and it becomes necessary to discontinue the iodine, at least temporarily.

When the inflammation assumes a more chronic course the tincture of iodine is painted every third day on the vaginal vault, when it comes in more direct communication with the affected parts. This is, of course, done with a speculum, preferably Sims', and care should be taken to avoid the lower part of the vagina, the vulva, and the skin, where it smarts, while it is not felt at all at the vault. In patients who move about it is even wise to wipe off the redundant tincture with a little absorbent cotton, so as to prevent it from running down to the sensitive parts. I use the plain tincture of the United States Pharmacopœia, since once I saw ulcers produced by using Churchill's stronger solution.

Some use blisters or blue ointment, in the hope of scattering the inflammation: of late years I have entirely abstained from them. Blisters are painful, lower the vitality, and sometimes give rise to urinary trouble. Mercurial ointment, in such doses that it has any influence on the swelling, is very apt to cause salivation; and neither blister nor ointment has given me so good results as the other remedies.

If the inflammation becomes suppurative, the process may be shortened by the application of warm linseed-meal poultices, and as soon as fluctuation can be made out the abscess ought to be opened with the bistoury. In doubtful cases it is advisable to clear the diagnosis by means of a well-disinfected aspirator-needle, and when pus is present to use the needle as a guide for the knife. In larger abscesses one or more soft-rubber drains are left to ensure a free discharge. If the incision is made from the skin, this is of course disinfected, and the wound treated according to the general rules of antiseptic surgery. If it is in the vagina, all that can be done is to rub the vaginal mucous membrane with solution of bichloride of mercury or creolin before incision, to wash out the cavity of the abscess with creolin, use vaginal injections with the same, and put on the perineal pad.

If an abscess communicating with the intestine does not close, it is necessary to make a counter-opening to the skin. The internal treatment is the same as above.

LYMPHANGITIS.—In lymphangitis of the vulva and the groin, these parts are covered with compresses dipped in a lead-and-opium wash (Tr. opii. ℥ss; Liq. plumbi subacet. dil., ad viij.). If an abscess seems to form, it is treated as just mentioned in speaking of Cellulitis. General treatment is hardly required.

Lymphangitis of the uterus is treated with an ice-bag, as described under Metritis. The bowels are kept open. Quinine, alcohol, and morphine are administered, as in other inflammations.

PERITONITIS.—The chief remedies to combat this dangerous form of puerperal infection are antiseptic injections, ice-bags, opiates, and alcohol.

Some think that, absorption having already taken place, it is useless to wash out the uterus; but since the source of the poison in the vast majority of cases is in the uterus, and since its absorption is likely to go on, it seems rational to me to begin treatment by a thorough disinfection of the uterine cavity. As, on the other hand, absolute rest is of great importance, I do not repeat the injection in this form of the disease.

Two large, flat rubber bags are placed on the abdomen, and kept well provided with ice. In order to take off part of the weight of the ice, the bags are suspended to a cradle placed over the abdomen, and the remainder is not felt on account of the stupefying effect of the narcotic.

Instead of the ice-bag, a rubber coil with running ice-water may be used, but has not appeared to me to present any advantages. It is more troublesome to put up and keep in order, and is rather expensive. If it is used, a pail with ice-water must be placed at a suitable height above the patient. Into this the afferent end of the tube with a strainer should be plunged. From the other end the water runs into another pail placed under the bed. If, exceptionally, cold is contraindicated, warm poultices may be substituted.

The opiate I prefer is Magendie's solution (two grains of sulphate of morphine to a fluiddrachm of distilled water). In order to relieve the patient as soon as possible from the severity of her pains, the treatment is best begun with a hypodermic injection of a quarter of a grain. If this does not suffice, smaller doses are added. When once relief is obtained, I prefer to give the drug through the mouth, in doses of one-eighth to one-fourth of a grain, about every half hour until the patient is fully under its influence. In my opinion, the administration through the mouth is preferable, because the drug comes in more direct contact with the diseased parts; because I have seen the opening made by the needle of the hypodermic syringe become the starting-point of a fatal infection, and often give rise to abscesses; and, finally, because the injection ought only to be made by a doctor, who, as a rule, cannot be in so constant attendance, whereas a reliable nurse may be intrusted with the administration through the mouth. If the morphine is rejected from the stomach, it must be given hypodermically, but the drug itself has great power to restrain vomiting. In the respiration we have a reliable guide as to the limit of safety. It is safe to use the remedy with such short intervals until the number of inspirations sinks to fourteen or even twelve per minute. Then longer intervals are called for. The condition we want to produce is freedom from pain, and yet not greater stupor than that from which the patient can be easily roused.

Through the influence of Mr. Tait peritonitis is now often treated with aperients and opium proscribed. While this may be preferable in that form of the disease which follows gynecological operations, and probably owes its effects to the removal from the system of septic material, I can only warn against it in puerperal peritonitis. When I was a student this disease was treated with large doses of an aperient medicine, of which senna was a chief component, warm poultices, or a coating of collodium smeared over the abdomen, and insignificant doses of opium. The aspect of the poor women who received this treatment has impressed itself indelibly on my mind as something of the most horrible I have ever seen. Lying immovable, with pinched features, turned-up eyes, shallow, panting respiration, and screaming if anybody touched them, they looked as if they were being tortured on the rack; and the only consolation was to know that they soon would succumb to the combined effects of the malady and the treatment. Young as we were, and not knowing that other remedies were resorted to in other places, it struck us students as absolutely fatal to follow this treatment, so sure were we soon to see the patients removed from the ward to the dead-house. How different it is with the "opium plan"! The patient is free from pain, is ignorant of her dangerous condition, does not even feel the weight of the ice, and has about even chances of recovery and death.

If the morphine has a too depressing effect, especially if the action of the heart is weak, atropine may be added to great advantage. By taking 1 part of sulphate of atropine to 1000 parts of Magendie's solution, the mixture may be administered according to the rule laid down for morphine alone. Dr. T. Herring Burchard, in an excellent paper on peritonitis,[1] advocates the use of large doses of atropine—from one-sixtieth to one-tenth of a grain. I have never given more than represented by the lowest of these figures. The highest is a toxical dose,[2] but that does not prevent it from saving life under peculiar circumstances. Dr. Burchard warns against giving opium during the initial collapse.

Next to morphine, alcohol is the most important remedy in puerperal peritonitis. One-half to one ounce of brandy or whiskey should be taken about every two hours. Other excellent stimulants and tonics are a strong infusion of coffee, taken without milk, and strong beef tea. Excellent beef tea can be made from fresh meat by cutting it in quite small cubes; put these in a bottle with twenty drops of dilute hydrochloric acid and just water enough to bring the acid in contact with all the meat. The bottle is corked and placed in a vessel with water which is brought to the boiling-point, and kept there for an hour and a half. If more bulk is desired, the acid may be added to a pint of cold water and poured on a pound of finely-cut meat. It should stand for an hour or more, and be stirred up occasionally. Then the vessel is put over a fire until it reaches the boiling-point, when it is removed, the contents strained through a fine cloth, and salt added to taste.

Of the many meat preparations found on the market, Valentine's meat-juice seems to me to have the advantage of being very palatable. Rudisch's beef peptonoids may be used for beef tea or eaten as a solid. It is so concentrated that a single teaspoonful is quite a meal for a sick person.

I give quinine in five-grain doses every four hours.

No medicine is given to move the bowels. From time to time there will be a spontaneous discharge. Otherwise an enema is given. One I rather like is composed of an infusion of linseed meal one quart, with a tablespoonful of castor oil and a teaspoonful of spirits of turpentine. The injection of about two fluiddrachms of glycerin by means of a small hard-rubber syringe has likewise, in my hands, been followed by a prompt and abundant evacuation. It softens the hardest scybala and produces a desire for defecation. Great relief is often afforded by the introduction of a soft-rubber rectal tube, through which flatus is discharged.

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[1] T. H. Burchard: *New York Med. Journ.*, August 15, 1885.

[2] "A tenth, or even a twentieth, of a grain of atropine will often produce alarming symptoms" (H. C. Wood: *Therapeutics*, 7th ed., Philadelphia, 1888).

As to diet, the patient receives only milk, beef tea, and oatmeal gruel. In order to give an idea of the amount of medicine and food given in peritonitis, I may mention that one of my patients in twenty-three days took 216 grains of morphine, 228 ounces of whiskey, 1078 ounces of milk, and 418 ounces of beef tea, making an average of 9 grains of morphine, 9½ ounces of whiskey, 45 ounces of milk, 7½ ounces of beef tea in twenty-four hours. The greatest amount of morphine given in one day was 13¾ grains.

This outline gives an idea of the way in which I treat these cases myself; but in a work of this kind it may be advisable briefly to mention some modes of treatment used by others. Some use a moderate number of leeches, say eight or ten, or take some blood by cupping: it relieves pain and combats inflammation, but it weakens the patient. Bloodletting from the vein has been entirely abandoned.

As to blisters and blue ointment, I refer to what has just been said under the heading "Cellulitis."

Emetics are likewise very depressing, and we cannot in that way deliver the patient of the poison that threatens her life.

I have already spoken of purgatives.

Some use aconite or veratrum viride. The latter drug is much praised by Dr. Fordyce Barker in his *Lectures on Puerperal Diseases.* Of this class of drugs, heart sedatives, digitalis is most used nowadays. Having spoken of it under Metritis, I refer the reader to that division.

Many use antipyretics extensively—quinine, salicylate of soda, and antipyrine. To give large doses of these drugs seems to me rather to mask the disease then to cure it. The small doses of quinine I use have hardly any direct influence on the temperature, but keep the whole system under the tonic and antiphlogistic influence of this valuable remedy. Salicylate of sodium is a very debilitating drug, and, as the chief indication is to keep up the flagging strength of the patient, I am not in favor of its use. Antipyrine I have occasionally used in fifteen-grain doses, with good effect so far as the lowering of the temperature goes, but otherwise it does not seem to have any virtue. Among the antipyretics I would likewise place carbolic acid. Given in minim doses every hour in a mucilaginous mixture, it has a decided influence on offensive diarrhœal discharges and lowers the temperature.

A valuable means of reducing the temperature is cold. If, in spite of intra-uterine tonic and sedative treatment, the temperature remains high, in the Maternity Hospital we use frequent sponging of the whole body, either with cold water alone or a mixture of water and alcohol.

This procedure can be carried out without disturbing the patient, and is rather grateful to her. The same cannot be said of the cold pack and the cold bath; but then they are much more powerful and have been highly recommended. If the cold pack is resorted to, it ought to be administered in the following way: Two beds are needed. They are covered with rubber sheets or oil-cloth and a blanket. A muslin sheet is wrung out of cold water and spread over the bed. The patient is lifted over on the sheet, which is wrapped round her, leaving the feet free. If the circulation is bad, it may even be necessary to apply hot bottles to them. A blanket or two are laid over all. At the end of about ten minutes the patient is removed to the first bed, which in the mean time has been prepared in the same way. Four or six packs are needed to make an impression on the temperature if the fever is high.

A better way of administering cold is by means of Kibbee's fever-cot, consisting of a wooden frame to which is attached a cotton netting, and under that a rubber sheet adjusted in such a way as to lead water into a pail placed at the end of the cot. Dr. T. G. Thomas has spoken very highly of this apparatus.[1] He describes its use in the following terms: "Upon this cot a folded blanket is laid, so as to protect the patient's body from cutting by the cords of the netting, and at one end is placed a pillow covered with india-rubber cloth, and a folded sheet is laid across the middle of the cot about two-thirds of its extent. Upon this the patient is now laid, her clothing is lifted up to the armpits, and the body enveloped by the folded sheet, which extends from the axillæ to a little below the trochanters. The legs are covered by flannel drawers and the feet by warm woollen stockings, and against the soles of the latter bottles of warm water are placed. Two blankets are then placed over her, and the application of water is made. Turning the blankets down below the pelvis, the physician now takes a large pitcher of water, from 75° to 80°, and pours it gently over the sheet. This it saturates, and then, percolating the network, it is caught by the india-rubber apron beneath, and, running down the gutter formed by this, is received in a tub placed at its extremity for that purpose. Water at higher or lower degrees of heat than this may be used. As a rule, it is better to begin with a high temperature, 85° or even 90°, and gradually diminish it. . . . . It is better to pour water at a moderate degree of coldness over the surface for ten or fifteen minutes than to pour a colder fluid for a shorter time. . . . . At the end of every hour the result of the affusion is tested by the thermometer; and if the temperature has not fallen another affusion is practised, and this is kept up until the temperature comes down to 100° or even less."

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[1] *New York Medical Journal*, August, 1878.

This fever-cot seems to me the best means of applying cold to the trunk. When it is not to be obtained and general refrigeration is wanted, recourse may be had to cold baths. The patient should be placed in a bath-tub with water near or at blood-heat. She is least disturbed by lifting her on the sheet on which she lies and letting her with this gently down into the water. Then the warm water is gradually replaced by cold water until it reaches about 80°. This is a very powerful means of abstracting heat, and I have seen it save life in desperate cases; but it can only be used where a bath-tub and considerable assistance are at command. It ought only to be used under the personal supervision of the physician, as the effect has to be very closely watched. In order to prevent heart-failure it is good to give a tablespoonful of brandy before the bath, and remove the patient as soon as her condition seems to get worse. Otherwise she may remain in the water for fifteen or twenty minutes. After her removal she should be wrapped in blankets and replaced in bed.

Max Runge[1] has recently advocated a treatment embodying several points of those mentioned here. He deprecates the use of antipyretics, but praises cold baths (82° Fahr.) once or twice a day for seven minutes. He gives frequent alcoholic drinks—a bottle of port or madeira wine daily, besides five or six ounces of brandy. As it is not very likely that the so-called madeira and port at command in a German hospital have much to do with Portugal or the island of Madeira, they too may safely be looked upon as a mixture of brandy. The original point in his treatment is the free administration of food. He allows not only tea, milk, and beef tea, but eggs, cutlet, and ham. He claims 15 recoveries out of 20 patients. Of the 5 who died, 4 were suffering from uncontrollable vomiting, so that the treatment was not available. Some of the cases were evidently mild, but others with very bad symptoms, such as peritonitis, repeated rigors or localization in the lungs, were found among those who recovered.

I find hardly any reference made anywhere to laparotomy, and still I think the time cannot be far off when, guided by the experience gained in the operative treatment of both chronic and acute peritonitis, we will not allow a woman to die of puerperal peritonitis without giving her the slight chance of recovery offered by that operation. Spiegelberg[2] had the idea, but he did not go farther than to tap the abdominal cavity of a moribund woman, although he saw an amelioration lasting several hours follow the experiment. Sonnenburg[3] performed laparotomy on a person who shortly before had given birth to a child, and in whom perimetritis had developed during the lying-in period. A pelvic abscess ruptured into the peritoneal cavity, causing general peritonitis with collapse, when Sonnenburg opened the abdomen, from which the pus poured out in a stream, cleansed the peritoneum with a solution of salicylic acid, and inserted a drainage-tube. The patient recovered.

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[1] Runge: *Archiv für Gynäkologie*, vol. xxxiii. No. 1, p. 39, 1888.

[2] Spiegelberg: *Lehrbuch der Geburtshülfe*, Lahr, 1878, p. 754.

[3] Sonnenburg: *Centralblatt für Gynäkol.*, 1885, vol. ix. p. 238.

Tapping or aspiration can hardly be expected to do any good. If we will operate at all, it ought to be by laparotomy, and if this shall have any chance of saving the patient, it ought to be performed early, before her whole system is so poisoned that she is beyond recovery. Since we know that the microbes come from the genital canal, mostly follow the lymphatics, invade the peritoneum, and are likely to pursue their route to other organs, it would seem rational to stop their migration, turn out what we can from the abdominal cavity during the operation, and leave a permanent outlet for pus and microbes that may be formed later. The difficulty is that at the time when the operation might do the most good the patient and her friends may not realize the enormous danger of her condition, and the physician may hesitate to take the risk of an operation that is more likely to bring him blame than glory. If it were true, as some say, that general peritonitis in puerperal infection is absolutely fatal,[1] there would be more inclination toward operation, in order to try if perhaps puerperal peritonitis would yield similar results to those obtained when the disease is caused by the rupture of the intestines or the bladder, gunshot wound, etc.[2]

But when it is taken into consideration that a certain number of patients may recover under medical treatment, and that the shock of the operation may make the condition worse, there will naturally yet be a strong bias in favor of abstention.

When, later in the disease, there is an encysted peritonitis, there can no longer be any doubt about the advisability of performing laparotomy.

PLEURISY.—If the inflammation affects the pleura, special indications present themselves. The pain and the exudation may be combated by the application of an ice-bag if the seat of the disease is accessible without disturbing the patient and her vitality is not too low. Under the opposite conditions a warm linseed-meal poultice should be preferred. A very convenient way of applying heat to the chest is by means of spongio-piline; that is, thick felt covered with a layer of gutta-percha. It is simply dipped in hot water, retains the heat well, and is light.

Internally, diuretics may be tried, especially iodide, acetate, bitartrate, and citrate of potassium, a decoction of the root of *Triticum repens*, and digitalis. A favorite formula with me is the decoction of *Triticum repens* (℥j to Oj), with acetate, bitartrate, citrate of potassium (āā. ʒij). M. S. A tablespoonful four or six times a day.

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[1] Siredey: *loc. cit.*, p. 211: "La peritonite partielle guérit presque toujours; la peritonite généralisée est fatalement mortelle."

[2] Burchard collected 39 cases with 23 recoveries, or 60 per cent., in the above-mentioned paper.

The amount of fluid accumulated in the pleural cavity is rarely large enough to necessitate aspiration. In more chronic cases the empyæma operation, with resection of a piece of a rib, may be called for.

PNEUMONIA.—When the lung becomes inflamed the chest should be covered with large warm poultices. Besides quinine and alcohol, which are always in order in puerperal infection, I use ammonia. I prescribe two sets of powders—one containing ten grains of carbonate of ammonia, the other twelve grains of citric acid and as much sugar. One powder of each set is dissolved in an ounce of water, and the two poured together. Thus citrate of ammonia and free carbonic acid are formed. Be it that the salt of the mixture counteracts the formation of fibrinous plugs, as has been claimed, or that the medicine simply works as a stimulant, it seems to me to have a good influence on the pneumonia, and it is a refreshing drink to take for the patient.

As the pneumonia is mostly hypostatic, care should be taken, if the patient's condition otherwise allows it, to change her position from side to side.

The œdema that frequently accompanies the pneumonia and jeopardizes the patient's life is often successfully combated by dry cupping.

ENDOCARDITIS AND PERICARDITIS.—The inflammations of the heart in puerperal infection are hardly within reach of our therapeutic resources. All we can do is to try to give some relief by means of cold or hot applications, as in pleurisy, to attract blood from the inflamed parts to the skin by means of dry cupping, and to strengthen the heart by such remedies as digitalis or strophantus.

ENTERITIS.—The stinking diarrhœa is best treated with one-minim doses of carbolic acid in a mucilaginous mixture, given every hour. Or the compound tincture of iodine may be administered in the same way, or both combined. Enemas of corn starch (a teaspoonful) with laudanum (twenty-five drops) give great relief when there is tenesmus. A teaspoonful of subnitrate of bismuth may be added with advantage.

HEPATITIS.—When the liver is inflamed the right hypochondrium should be covered with a warm poultice. If there is sluggishness of the bowels, calomel (five to ten grains) is preferred as a laxative. as it has a special effect on the secretion of the bile.

NEPHRITIS.—A poultice is applied to the loins. The secretion of urine is increased by digitalis, potassa salts, and dog-grass, as stated under "Pleurisy." Leaves of digitalis may be put in a bag, soaked in hot water, and used as a poultice. If diuretics fail and there are uræmic symptoms, we try to eliminate the poison through the skin and the bowels. The first is best done by the hot-air bath, which can be improvised by placing an alcohol lamp under a chair covered with a waterproof next to the side of the bed, and an umbrella over the abdomen. The hot air rises and gets in under the bed-clothes, and soon a profuse perspiration is obtained.

The strongest purgatives, as croton oil, elaterium, or gamboge, are sometimes needed to move the bowels. Croton oil may be given in pills containing each half a minim, one pill every half hour till they operate. If the patient cannot swallow, two drops may be mixed with a little butter and rubbed on the tongue. The dose of commercial elaterium is $\frac{1}{4}$ to $\frac{1}{2}$ grain every half hour, of Clutterbuck's, $\frac{1}{8}$ grain; of elaterin, $\frac{1}{16}$ to $\frac{1}{12}$ grain. The full dose of gamboge is 2 to 6 grains, but it is better to give small doses at short intervals.

Small doses of chloral seem to have the effect of diminishing the albuminuria. I give fifteen grains every evening, and tinct. ferri chloridi, fifteen to twenty drops, four times a day. The diet should consist of skimmed or peptonized milk exclusively.

Vomiting is so troublesome a symptom that it deserves special consideration. It is more or less successfully combated with morphine, dilute hydrocyanic acid, bismuth, strychnine, tincture of iodine, carbolic acid, creasote, ice-lumps, Vichy water, etc. If the stomach cannot be quieted and the case is a protracted one, all food should be withheld and the patient fed through the rectum. Leube-Rosenthal's solution of meat or Rudisch's beef peptonoids are particularly well adapted for this purpose. Where they cannot be procured a pretty good nutrient enema may be composed of an egg, a tablespoonful of brandy, and four ounces of milk.

Encephalitis and Meningitis.—If the brain or its envelopes are the seat of the localization, little can be done with any prospect of benefit. Still, the head should be covered with an ice-bag or Thornton's cap of rubber coil with running ice-water. Ergot and chloride of barium (twenty minims of the liquor every four hours) may be given, besides quinine, in the hope of contracting the blood-vessels and counteracting the migration of the colorless blood-corpuscles. The bromides and chloral may be called for to allay excitement. The bowels should be kept rather loose if they are not already so.

Delirium is quieted by means of opiates, choral, and bromides.

Abscesses in the subcutaneous or intermuscular connective tissue are opened and treated according to the rules of antiseptic surgery.

Arthritis.—If the localization takes place in a joint, this must first of all be immobilized in a proper position by means of splints and bandages; but they ought to be applied so as not to interfere with other treatment. I have seen excellent results from the application of an ice-bag round the affected joint. Later, tincture of iodine or blisters may be of use. If pus is formed, it may become necessary to treat the joint, according to the general rules of surgery, with aspiration and irrigation with a solution of carbolic acid (3 to 5 per cent.), creolin (2 per cent.) or incision.

SKIN.—The eruptions on the skin caused by puerperal infection will hardly call for any special treatment. In cases where the patients complained of itching I have seen considerable relief from frequent washing with a 1 per cent. solution of carbolic acid. Complicating eruptive fevers will be discussed elsewhere.

Great attention should be paid to *bed-sores*. At the first warning in the shape of an even redness over the sacrum, trochanters, heels, or other parts exposed to much pressure, the affected part should be protected by placing it on an air-cushion, and the patient, if possible, should lie so as to avoid pressure on that point. For the heels there are small rubber rings to be had at the instrument-makers' or in the rubber stores, or they may be improvised by winding a strip of muslin in a spiral line around a little oakum. The affected spot should be bathed frequently with lead-water.

If the epidermis has already been lost in some places, the part should be dressed with glycerate of tannin, one part to four, or an ointment with iodoform (ʒj), Peruvian balsam (ʒij), and vaseline (℥j).

If there is gangrene, the dead tissue should be removed with scissors or the knife as soon as a line of demarcation is formed, and the ulcer dressed with pledgets of absorbent cotton or lint soaked in camphor emulsion (camphoræ, ℥ss; mucilag. acaciæ, ℥j; aquæ, ℥iv), which brings on a wonderfully rich granulation. When once the hole is filled the milder remedies may be substituted. Pledgets soaked in creolin emulsion (2 per cent.) are said to have a similar stimulating effect.

A mattress filled with water proves an excellent couch in severer cases. I believe it is only in a mechanical way that the water works. The couch adapts itself better to the patient than any other mattress, so that the pressure is very even, and all movements are much facilitated by the escape of the water from the part toward which the patient moves. I mention this because I have seen water placed in a tub under the bed, or even a bed particularly made with a metal compartment in the lower part to be filled with water, in the belief that the mere neighborhood of water, without contact, exercises a beneficial effect on bed-sores.

PHLEBITIS.—1. *Phlegmasia alba dolens.*—The part should be kept immobile. The places where swollen veins can be felt are painted with tincture of iodine. The whole limb is covered with cotton, very slightly compressed with roller bandages, and elevated on cushions. In protracted cases I have changed the iodine for blue ointment. In order to avoid the danger of tearing off a part of a thrombus by pressure, the ointment ought to be smeared on the skin only with great care.

As there is great tendency to relapse, the patient ought to be kept on a lounge or an easy-chair for a fortnight after she leaves the bed and treatment is discontinued. If circumscribed abscesses form, they are matured with warm poultices, opened, and dressed antiseptically. In the diffuse phlegmonous form several large incisions through skin and fascia are called for at an early date in order to limit the destruction of tissue.

2. *The Inflammation of Varicose Veins* is also treated with absolute rest and elevated position. The affected part is covered with compresses soaked in lead-and-opium wash. The effect is greater if they are kept cool, but in this we may conform to the wishes of the patient. Sometimes warm linseed-meal poultices have a more soothing effect. When all pain is gone compression may be used to reduce the swelling. At first the limb is enveloped with a roller bandage. Later, when the patient is up and about, an elastic stocking is preferable.

3. *Uterine Phlebitis* calls for all the local and general treatment we have described in the preceding pages, according to the special features every case presents, especially ice-bags or poultices, quinine, and alcohol.

ACUTEST SEPTICÆMIA.—In those cases which have so rapid a course that the usual organic changes do not find time to take place before the patient succumbs, therapeutics are, of course, nearly powerless. Still, in order to give the patient whatever chances we can, we will go to work according to the principles laid down above. We will especially disinfect the parturient canal, moderate the high temperature, give large and frequent doses of quinine, alcohol, digitalis, and atropine, and relieve pain and excitement by means of the hypodermic injection of small doses of morphine.

INFLAMMATION OF THE BREASTS AND ALLIED DISEASES CONNECTED WITH CHILDBIRTH.

BY HENRY J. GARRIGUES, A. M., M. D.,

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Sore Nipples.

During lactation the nipples become the seat of several diseased conditions which commonly are united under the general term "sore nipples." The most common form is an abrasion due to the loss of the epithelium on a more or less roundish surface near the upper end. In other cases linear ulcers are formed, especially near the base. These may become so deep that the nipple remains only attached by a few lactiferous ducts, or is even entirely torn off. The nipple may be the seat of simple granulating ulcerations or the specific ulcer of syphilis. An eczema is sometimes developed here as well as on the areola.

The predisposing cause of common sore nipples is the thinness of the epithelium and the shortness of the nipple. These conditions are often themselves due to neglect during pregnancy. If the nipples are not kept clean, drops of milk and old epidermal cells often form together a crust, under which the epithelium atrophies and becomes excessively tender. The pressure from stiff corsets prevents the physiological growth and increased prominence of the nipple by which Nature prepares this organ for its function during lactation.

The direct cause is probably the injury brought on by the child biting the nipple with its gums and licking it with its tongue—acts which will be so much more liable to tear off the epithelium and attack the deeper tissue as the part is constantly bathed in milk, and has to be kept warm in order to avoid other trouble.

Others think that the mechanical injury is of little or no account, and attribute the excoriations and ulcerations exclusively to the presence of vegetable parasites. Ign. Berger[1] found in every case in the beginning oïdium lactis, which he believes is identical with oïdium albicans. Some think a child with sprue may cause the sore nipple, but others pretend that it is more likely the sprue is the secondary affection brought on by sucking a breast which contains the oïdium.

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[1] Berger: *Centralblatt fur Gynäkologie*, 1884, vol. viii. p. 819.

The eczema seems to be the result of lack of cleanliness. I have only seen it in private practice among the lower classes, never in well-to-do private patients nor in the Maternity Hospital. It is independent of eczema in other parts of the body.

The syphilitic ulcer is mostly caused in a healthy nurse by the bite of a syphilitic child.

A sore nipple causes great pain when the child nurses, may produce great nervous irritability, even in the intervals between nursing, by the mere thought of the ordeal to be encountered, and may be accompanied by a rise in temperature up to 104° Fahr.—a circumstance which it is good to bear in mind when all other causes of fever can be excluded.

Sore nipples, besides being in themselves a painful affection, may become the source of mastitis, and the greatest attention ought therefore to be given both to their prevention and their cure.

TREATMENT.—The preventive treatment should begin during pregnancy. The nipples and the nearest part of the areola ought to be washed once a day during the last two or three months with some astringent or spirituous fluid. Brandy or whiskey undiluted, or alcohol mixed with equal parts of water, is as good as any. With more refined women cologne is preferable, on account of its pleasant odor.

If there are scabs on the nipples, they ought to be softened by some suitable application—for instance, lead-water and thin oatmeal gruel, equal parts—and removed before beginning the hardening treatment.

Small nipples may be made longer by cautiously pulling on them with the thumb and two fingers for a minute or two every day. This manipulation is, however, apt to cause uterine contraction, and would therefore be contraindicated in a person suffering from habitual abortion.

During the latter half of pregnancy women ought only to wear entirely soft and yielding corsets and loose dresses which cannot exercise any pressure on the nipples.

As curative treatment a great many drugs and appliances have been recommended. Our treatment in the Maternity Hospital is very simple, and at the same time so effective that we entirely avoid mammary abscesses. As soon as there is the slightest erosion of the nipple it is dusted with dry tannin and a small circular piece of lint is placed over it. In order to prevent this from sticking, it is smeared with a little glycerin or vaseline, and kept in place by the jacket to be described under "Mastitis." The tannin forms a kind of artificial epidermis over the denuded place, that does not even come off when the nipple is washed, which is done before and after each nursing. Very often the affection heals under this treatment, although nursing is continued.

If the sore is large and the pain considerable, nursing is interrupted for a shorter or longer period, the maximum being four days, and the breasts are relieved by milking them with the fingers, much in the same way as milk is drawn from a cow's udder. The difference between this and nursing is that the nurse who milks out the breasts carefully avoids touching the sore places. On the other hand, this is entirely different from, and much preferable to, the coarse kneading of the breasts which was used in the hospital until I first began to regulate the breast treatment, and also to all kinds of breast-pumps, which hurt the patient and by the pressure exercised by their edges on the breast around the nipple rather promote than prevent mastitis.

A soft-rubber nipple-shield, kept scrupulously clean with carbolized and plain water, offers sometimes a grateful protection for the sore nipple during lactation; but often the baby, in spite of all coaxing, cannot be made to suckle through it.

These are all the measures we take to cure sore nipples, and the result is most satisfactory. Of the many other ways of treating them I may mention a few. A 5 per cent. solution of carbolic acid is used on compresses to cover the nipple with,[1] or simply applied with a camel's-hair brush.[2] This is a rational treatment for those who look upon the disease as the work of microbes, but a solution of that strength smarts considerably in an open sore, and any kind of fluid is, in my opinion, less good than the dry treatment, because it macerates the epithelium and is apt to make the condition worse rather than better. Another favorite remedy is nitrate of silver, either as a solid stick, with which the sore is touched, or as a solution, which is painted over it. It combines the two good properties of being an astringent and an antiseptic, but it is exceedingly painful. A remedy I have not seen mentioned, but which I would try if I needed to look round for something new, is chloral hydrate. Since in a 4 per cent. solution it works on anal fissures like a charm, I do not see why it should not have a similar effect on mammillary fissures. It has great antiseptic power and combats pain. Compound tincture of benzoin was formerly the remedy used in Maternity Hospital. I have seen vaseline have an excellent effect. Collodium, goldbeaters' skin, plaster strips, have been used to form a cover over the whole or part of the nipple, but fail to offer the protection sought.

If granulating ulcers resist the milder treatment recommended above, it may become necessary to touch them with lunar caustic.

Syphilitic ulcers call for local and general specific treatment according to the rules of treatment for that disease. If a syphilitic child is the cause of a syphilitic ulcer on the breast of a nurse, there is nothing gained by weaning it; but if such ulcers should appear from any other cause, the child ought in its own interest immediately to be taken away from the nurse. If the relations are those of mother and child, lactation may continue, for the milk cannot bring more poison to the child than the blood from which its body has been formed, unless the disease has been contracted after the birth of the child.

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[1] Haussmann: *Centralblatt für Gynäk.*, 1878, vol. ii. p. 233.

[2] Steiner: *Ibid.* p. 402.

Eczema is best treated with the mixture of lead-water and oatmeal mentioned above until all scabs have come off, and then with diachylon ointment, and finally with a powder of zinc oxide and starch: (℞. Zinci oxydi, ʒj ; amyli, ℥j. M.). If there is much itching, camphor, ʒj, may be added, or if the skin is healed a lotion with carbolic acid may be substituted (℞. Acidi carbolici, flʒss ; alcohol, glycerinæ, *āā*. fl℥ss ; aquæ, ad fl℥vj.)

DEEP INFLAMMATION OF THE NIPPLES.

Velpeau[1] has described an inflammation of the deeper part of the nipples which he says is rare. It may attack the lactiferous ducts or the intermediate connective tissue.

The first kind shows a more benign nature, causes only moderate swelling, and ends in small abscesses containing bluish, milky pus, which sometimes is seen to dribble from the nipple. If the child continues nursing it may swallow more or less of this matter, and consequently this form of inflammation is very dangerous for it.

The second kind, which has its seat in the connective tissue, is more painful, is accompanied by more rapid and more considerable swelling, and forms a globular abscess filled with thick, creamy pus, which is not evacuated through the normal apertures of the lactiferous ducts, and therefore is not so liable to be swallowed by the child.

If they do not soon end in resolution, both kinds of inflammation become so painful that suction is intolerable. When suppuration is established in the inflammation of the lactiferous ducts, the pus can only be evacuated through their normal apertures on the top of the nipple; in that of the connective tissue it breaks through or is opened artificially in the circumference, and soon dries up.

TREATMENT.—Lactation must be interrupted for a few days. Resolution may be attempted by means of mercurial ointment, iodide-of-lead ointment, a warm poultice, or the lead-and-opium wash; but the ice-bag would probably here, as in the inflammation of the breast itself, prove better than any other treatment. If suppuration is inevitable, the poultice favors the ripening of the abscess. If the abscess is situated in the ducts, nothing more is to be done; if in the connective tissue, it ought to be opened with the knife as soon as possible, and dressed with gauze wrung out of creolin or carbolic-acid solution (2 per cent.).

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[1] A. Velpeau: *Traité des Maladies du Sein*, Paris, 1854, pp. 15, 16.

ECZEMA OF THE AREOLA.

The areola, as well as the nipple, may be the seat of an eczema characterized by the formation of yellow or brown scabs, which irritate the patient by itching, and often resist treatment for some length of time. The treatment is the one just described in speaking of the same condition in the nipples.

CELLULITIS AND ADENITIS OF THE AREOLA.

The connective tissue under the areola and the sebaceous glands forming small prominences on the surface of this part may become inflamed and produce little abscesses. The skin reddens, small lumps are formed which are tender to the touch, and there are more or less pain and fever. If suppuration sets in, a yellow spot appears in the centre of the nodules; one or more openings perforate the skin, and leave a deep ulceration, followed by an unseemly scar or a hard nodule slow to disappear. This condition is chiefly due to the injuries caused by the attempts of the child to nurse from too short nipples (Winckel), but may also, like other inflammations of the breast, originate in sore nipples.

TREATMENT.—The disease can to a great extent be prevented by proper attention to the nipples. I have not seen a case for years, since the introduction of the above-mentioned treatment of the breasts.

Resolution may be attempted by means of the iodide-of-lead ointment or plaster and attention to sore nipples.

If suppuration is established, the small abscesses should be laid open without delay, and the breast covered with a thick gauze pad wrung out of a solution of creolin or carbolic acid (2 per cent.), when they heal in a few days.

ERYSIPELAS OF THE BREASTS.

Before the change of the service in the Maternity Hospital erysipelas of the breast was by no means a rare disease in our wards, and I have even seen it end fatally. It starts from excoriations of the nipples or a mammary abscess. Since Fehleisen has succeeded in finding the specific germ of erysipelas, we know that it is an infectious disease. The skin becomes dark red, hot, swollen, tender on pressure, and surrounded by the distinct boundary-line characteristic of the disease. It is accompanied by high temperature and the other symptoms of fever. In most cases it ends in desquamation. Sometimes it becomes bullous or gangrenous, and at other times it becomes complicated with inflammation of the cellular tissue.

TREATMENT.—Nursing from the sick breast must be discontinued, at least for a time, and in bad cases from both breasts. Internally, the tincture of chloride of iron should be given in large and frequent doses, say twenty drops every two hours. Externally, compresses dipped in ice-cold carbolized water, 1 or 2 per cent., or an ice-bag, gives relief and seems to localize and shorten the disease I have seen betanaphtol (gr. xxv. to ℥j of vaseline) arrest it. From the experience I recently have had with creolin in a case of facia erysipelas I would now prefer this substance to all others. It is smeared, undiluted, with a camel's-hair brush over, and one inch and more beyond, the affected surface morning and evening.

Bullæ ought to be opened and dressed with iodoform in powder, or if the denuded surface is too large, with iodoform-vaseline (ʒj to ℥j).

In the gangrenous form dead tissue is removed and the part dressed with lint, gauze, or absorbent cotton soaked in camphor emulsion (℞ Camphoræ, ℥ss; mucilag. acaciæ, fl℥j; aquæ, fl℥iv), or a solution of creolin (2 per cent.).

LYMPHANGITIS OF THE BREASTS.

According to Sappey,[1] there are in the breast two layers of lymphatics—a superficial or cutaneous layer, composed of a very delicate network covering the nipple and the areola; and a very rich deep or glandular layer, which envelops all the lobes and lobules of the mammary gland with its radicles. The trunks starting from this layer run from the posterior surface and the interior of the gland to the areola, where they form a plexus remarkable for the enormous volume of the vessels of which it is composed. From this plexus start two or three voluminous trunks which open in the lymphatic glands of the axilla.

In rare instances these latter trunks become inflamed, and appear on the skin as red, tender streaks extending from the nipple to the swollen axillary glands. This condition is accompanied by pain and fever.

The cause is an infection of sores on the nipple. In most cases the inflammation ends in resolution, but it may become suppurative, forming one or more small abscesses.

TREATMENT.—An even compression is instituted by means of the breast-binder to be described under "Mastitis," and an ice-bag applied outside of that and kept in place by means of a piece of muslin surrounding the chest and held together with safety-pins.

Internally, quinine is given in five-grain doses every four hours.

Nursing from the sick breast must be discontinued, at least provisionally.

If suppuration sets in, the small abscesses are opened and dressed with a pad of gauze wrung out of a solution of carbolic acid or creolin (2 per cent.), under which treatment they heal in a few days.

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[1] Sappey: *Traité d'Anatomie descriptive*, Paris, 1857-64, vol. iii. p. 698.

Maybe there is a similar affection of the deep lymphatics, but that can hardly be distinguished from mammary and submammary cellulitis.

MASTITIS.

Mastitis, or inflammation of the breast, is vulgarly called a weed in the breast.[1]

The right breast is more frequently affected than the left. Sometimes both are inflamed.

It is common, and of practical value in regard to symptoms and treatment, to distinguish three varieties as to the seat of the inflammation, viz.: the *subcutaneous*, the *glandular*, and the *subglandular* varieties. Of these the glandular is by far the most frequent.

ETIOLOGY.—One point has struck all observers: the disease is found almost exclusively in nursing women. It is exceedingly rare in puerperæ who never attempt the act of lactation, and in pregnant women. Its appearance, independently of gravidity and the puerperal state, lies without the scope of this article. On that subject the reader may find some information in the *System of Gynecology*, Vol. II. pp. 349–351.

When once it is conceded that mastitis is almost exclusively found in women who nurse their children, the next question that presents itself is, How does the act of lactation cause the inflammation of the breast? The most popular belief is that it is due to refrigeration; but, although exposure once in a rare while may cause an inflammation here as in other parts, the mere fact that the disease is entirely independent of season and climate goes far to show that cold has a very limited part in its production.

Among physicians it used to be the generally accepted opinion that mastitis was caused by stagnation of the milk in the lactiferous ducts. This theory is based on the observation that the inflammation is often preceded by a general or partial swelling of the breast, which is relieved by emptying the lactiferous ducts. It cannot, in justice, be said that it is disproved by the fact that mastitis is hardly ever found in puerperæ who do not attempt to nurse, for in these the secretion of milk is never well established. As a rule, it is carefully combated by the use of drugs and bandages. On the other hand, mastitis is never more common than in women who begin to nurse, and from some cause or other discontinue to do so after the function is well established.

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[1] *Medical Register*, March 9, 1889, edited by Dr. J. V. Shoemaker, Philadelphia, p. 228, editorial. Dr. W. Goodell of the same city uses, however, the term "weed" in a more restricted sense, as appears from these words of his: "A trouble sometimes met with is termed 'weed;' it occurs about the tenth day, and does not depend upon the existence of chapped or irritated nipples. The symptoms are headache, high temperature, and a tender breast, which becomes swelled and painful; it is flushed and purple, but not glistening; it is not caked. If quinia is given largely, with morphia to subdue pain, it soon disappears" (*Amer. Journ. Obstet.*, 1881, vol. xiv. p. 138). The dictionaries of the English language I have examined do not contain the word in the sense of a disease.

A few years ago the theory was promulgated that the inflammation of the breast was due to an infection taking place through the nipples.[1] The infecting substances were supposed to come from the lochial discharge, mycotic and ulcerative affections of the buccal cavity of the child, or unclean rags used for compresses or for washing the nipples. It was stated that, as a rule, the infection took place through erosions of the nipples, and only exceptionally through the intact apertures of the lactiferous ducts. The infection was said to be propagated through the lymphatics and interstices of the connective tissue, just as a parametritis originates from infected wounds of the cervix uteri.

This theory was soon corroborated from the side of the bacteriologists. Bumm[2] found in the matter taken from the depth of a mammary abscess numerous solitary samples and heaps of a diplococcus which was very like the gonococcus. He obtained a pure culture of this microbe, and produced abscesses by injecting it under the skin of several persons. He thinks that this diplococcus enters through the lactiferous ducts, progresses to the acini, gains the surrounding connective tissue, and causes an infiltration with leucocytes which softens and thus forms an abscess. Cohn[3] found in mammary abscesses Staphylococcus pyogenes aureus, and once Staphylococcus pyogenes albus, and in sore nipples and in the milk of inflamed breasts a streptococcus—*i. e.* a colony of cocci linked together so as to form chains. Schlösser[4] by the examination of numerous microscopical specimens, taken from eight cases of mastitis in the cow, came to the conclusion that in most cases mastitis is due to the immigration of schizomycetes through fissures and wounds of the nipples. These fungi cause fermentation of the milk in the lactiferous ducts, which, again, produces inflammation of the surrounding glandular tissue. Interlobular and interacinous infiltration with cells and the formation of abscesses follow. According to this author, the inflammation is always situated in the connective tissue and a true parenchymatous mastitis does not exist.

Not being versed in microbic investigations myself, I only repeat what I have found on the subject. Maybe infection by means of micro-organisms plays an important part in the production of mastitis, but in my opinion the other factor, the stasis of the milk, is of no less importance.

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[1] Kaltenbach: *Centralblatt für Gynäkologie*, 1883, vol. vii. pp. 65-72.

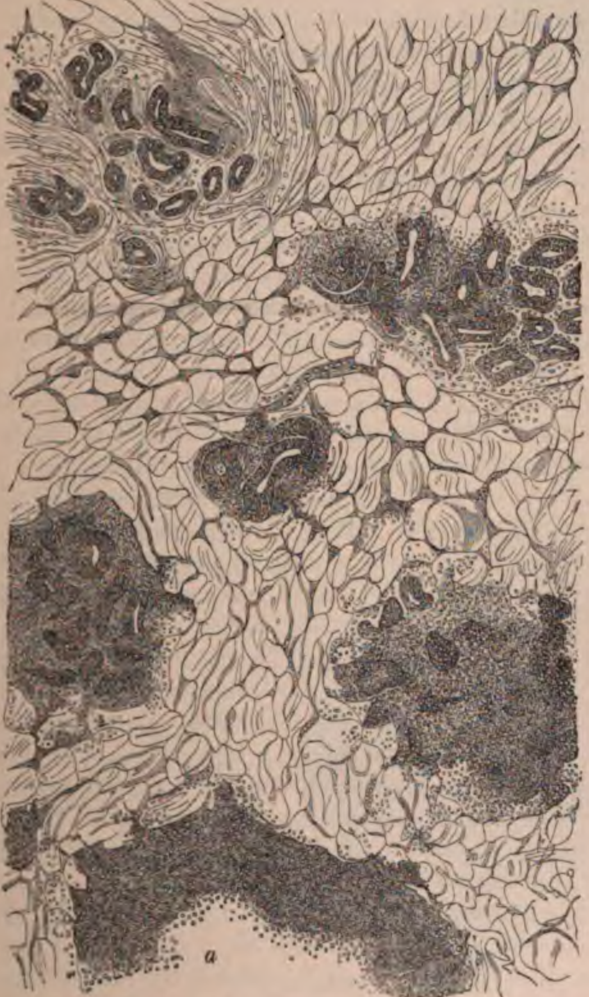
[2] E. Bumm: *Centralblatt für Gynäk.*, 1885, vol. ix. p. 36.

[3] Cohn: *Centralblatt f. Gynäk.*, 1885, vol. ix. p. 236.

[4] Schlösser: *Ibid.*, vol. ix. p. 30.

Kaltenbach's and Billroth's supposition, that the disease should follow the lymphatics from the nipple to the periphery, as in a case of parametritis following laceration of the cervix, leaves out of consideration the important fact that, as we have seen above, according to Sappey, the highest authority on the anatomy of the lymphatic system, the course of these vessels in the breast is from the base and circumference of the gland toward the nipple. It is therefore very unlikely that the infection should take place in a direction opposite to that of the current of the lymph. In consequence of a sore on a finger we get lymphan-

FIG. 101.



Puerperal Mastitis forming Abscess (Billroth): *a*, group of acini melted to pus.

gitis extending up to the axillary glands, but inflamed axillary glands do not produce inflammation of the fingers.

If microbes cause the evil, they must either wander through the meshes of the network formed by the connective tissue or follow the lactiferous ducts. That the latter is the common way seems to be proved by the investigations of Schlösser on the cow, and by the specimen described by Billroth (Fig. 101), in which all acini are more or less surrounded, in some places even entirely covered, by an infiltration with small round inflammatory cells. The cellular tissue between the acini is enormously developed, but entirely free from infiltration with inflammatory cells, except in the immediate neighborhood of the acini. It is not known how long the patient from whom the specimen was taken lived after confinement nor how long she nursed her child, but it is evident that the secretion had ceased long ago.

If the microbes enter the lactiferous ducts and cause fermentation of the milk, and secondarily inflammation of the connective tissue, it is evident that this process is favored by the stagnation of the milk in the ducts and is counteracted by its removal.

Our experience in the Maternity Hospital coincides entirely with this latter view. We have practically no mammary abscesses at all. For years I have only seen one there, and that was in a scrofulous little person who on her neck bore large cicatrices from suppurating glands in her childhood—a patient upon whom I performed Cæsarean section.[1] Now we will see later that all our treatment consists in the application of tannic acid to sore nipples, an even compression of the breasts, their depletion by sucking babies or by the fingers of the nurse, and occasionally an ice-bag. If that treatment can prevent the formation of mammary abscesses, the infection cannot be a very dangerous one, and the *corpus delicti* must be found in the lactiferous ducts.

I am still more inclined to lay the greatest stress on the stasis of the milk when I compare my hospital practice with my private practice. While I am free from mammary abscesses in the former, I cannot totally avoid them in the latter. Now, I take exactly the same precautions as to antiseptics in both kinds of practice, and I treat the breasts in the same way; but private nurses, even if trained in the Maternity Hospital, do not and cannot judge with the experience of our excellent head-nurse, Miss Marion Murphy, when to let the child nurse and when to milk the breast out; nor can they do the latter with such a degree of perfection as their teacher. This less perfect depletion of the breasts is, in my opinion, the only reason why I cannot obtain as good results as to mammary complications in my private as in my public practice.

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[1] Garrigues: "The Improved Cæsarean Section," *Amer. Journ. Med. Sci.*, May, 1888, pp. 439–456.

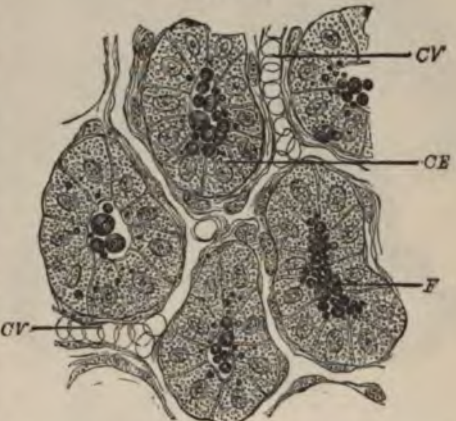
Whether mastitis is sometimes secondary to pyæmia originating in puerperal uterine phlebitis, or not, is hard to ascertain. Scharlau has published a case by which he tries to show it. Winckel has only seen one case; Hugenberger in the large epidemics of St. Petersburg none.[1] But since we have seen other glands secondarily affected in uterine phlebitis, such as the liver, the spleen, the tonsils, the parotid gland, and the thyroid body, it is not unlikely that a similar localization may take place in the mammary gland.

SYMPTOMS.—Whichever the variety of mastitis may be, the patient shows the common symptoms of an inflammation. The process begins with a chill or chilly sensations, followed by the sensation of heat; the temperature may rise to 104° Fahr.; the pulse is accelerated; the patient has headache, no appetite, but great thirst, and feels weak. The breast is painful, tender, swollen, red, and hot, but in these respects the different varieties differ somewhat.

1. The *subcutaneous variety* may, like cellulitis in other parts of the body, be circumscribed or diffuse. In the circumscribed form the skin over the inflamed tissue reddens rapidly; one or more points become soon prominent, and fluctuation becomes distinct at an early date. In order to feel it, it is best to fix the breast against the chest with the hollow of one hand and examine the swelling with the other hand and some of the fingers of the first, or to compress the breast from side to side with one hand and press with the index of the other on the prominent point.

The diffuse form has not received much attention, but is a very dangerous disease. As a rule, it begins as erysipelas, and extends from the skin inward to the subcutaneous tissue. If left to itself, it may break through the skin in many points; large shreds of dead connective tissue soaked in pus may be pulled out; and, finally, the whole mammary gland may appear as dissected at the bottom of the ulceration.

FIG. 102.



C E, cuboidal epthelial cells; *F*, fat-globules stained black with osmic acid, and seen both in the cells and in the central cavity of the acini; *C V*, connective-tissue frame with blood-vessels. Magnified 600 diameters (C. Heitzmann).

2. The *glandular variety* is by far the most frequent. When the opposite has been stated it is probably due to the circumstance that the

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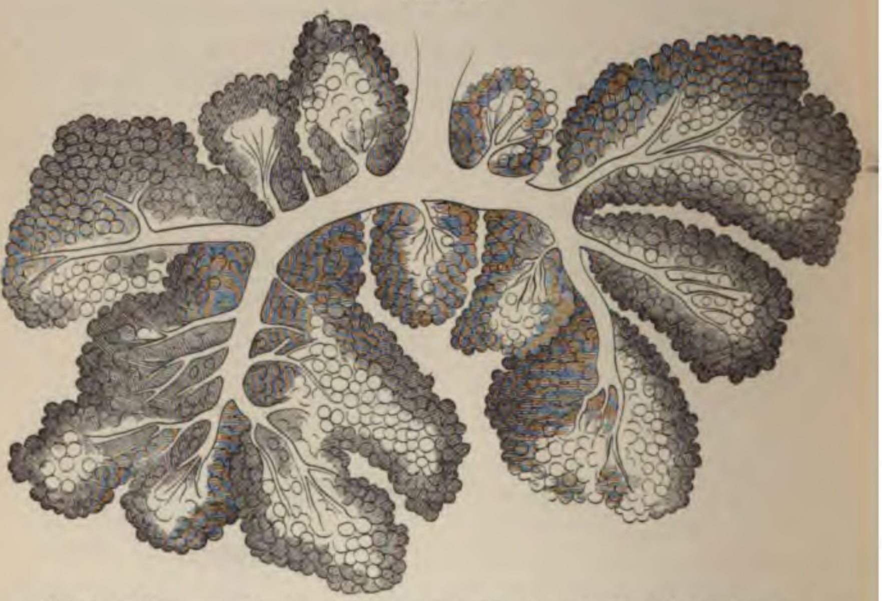
[1] Winckel: *Wochenbett Krankheiten*, 2d ed., Berlin, 1869, p. 391.

glandular abscess as a rule implicates the subcutaneous connective tissue and the skin in order to break on the surface of the body.

As to the anatomy and physiological development at different ages, and especially during pregnancy and lactation, the reader is referred to the *System of Gynecology*, Vol. II. pp. 335–338, as well as to the *System of Obstetrics*, Vol. I. pp. 342 and 524–526. Here I shall only add one of the excellent figures from C. Heitzmann's work on microscopical anatomy (Fig. 102.) It shows how the acini are lined with cuboidal epithelium, and at the beginning of lactation exhibit numerous fat-granules, both within the epithelial cells and in the central cavity of the acini. In full lactation the lobules and the acini therein assume the largest size; the epithelial cells are scarcely perceptible, for most of them are transformed to fat, and upon being treated with turpentine usually show the frame of cement-substance, the nuclei, and numerous vacuoles.[1] This corresponds with the investigations of Billroth, Schlösser,[2] and others, according to which the epithelial element takes no part in the inflammation of the mammary gland. Even in the glandular variety we have to deal with an inflammation of the connective tissue, and a parenchymatous mastitis does not exist.

FIG. 103.



Lobules of Mammary Gland of a Puerpera, artificially injected. Magnified 70 diameters (Langer).

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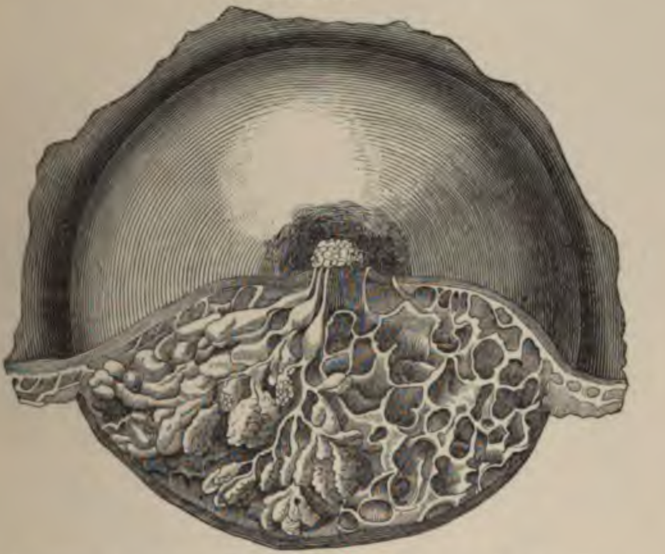
[1] C. Heitzmann: *Microscopical Morphology of the Animal Body in Health and Disease*, New York, 1883, p. 579.

[2] Billroth: *Loc. cit.*, p. 17; Schlösser: *Loc. cit.*, p. 30.

The great development of the lobules during lactation is well represented in Fig. 103. A good idea of the composition of the breast of a nursing woman may be derived from Fig. 104, and by combining this with Billroth's figure (p. 387) we can readily imagine how a glandular abscess is formed in different foci that gradually communicate and form an abscess.

In most cases the inflammation begins just outside of the acini, but it may be propagated to the gland from the subcutaneous or the subglandular variety. One or more hard, tender, round nodules or swollen tender lactiferous ducts are felt. The skin is at first normal, but becomes later red and sometimes œdematous. If suppuration supervenes, the hard mass softens in the centre, and slowly the softness extends in all directions. Such an abscess takes from one to three weeks or more to form. Often one abscess is developed after the other. Velpeau[1] has seen fifty-two in one breast. In such cases the process may extend over many months. From the gland the inflammation may invade the subglandular or the subcutaneous tissue.

FIG. 104.



Dissection of the Lower Half of the Breast during lactation (Luschka).

The inflammation of the gland begins most commonly in the second half of the first month after delivery, but may occur at any time, and becomes nearly as frequent after the tenth month as during the first;[2] which latter circumstance is probably due to the deteriorated condition of the milk at a period so remote from the birth of the child, and is one sign among others that lactation ought not to be kept up so long.

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[1] Velpeau: *Loc. cit.*, p. 129.

[2] Nunn, quoted by Winckel: *Loc. cit.*, p. 390.

As a rule, the PROGNOSIS is good as to life but in protracted cases with a long series of abscesses nearly the whole gland may be destroyed. Fatal hemorrhage is said to have occurred from erosion of vessels.[1] Mastitis may be the origin of septicæmia and death. Sometimes induration and fistulæ remain as sequels. Finally, the traction caused by old cicatrices predisposes to the recurrence of mastitis after following childbirths. Sometimes abscesses are found to contain stinking pus and gas; which is attributed to the neighborhood of the lungs or the origin in the lactiferous ducts (Velpeau).

Apart from true inflammation, there is often found a *congestion* of the mammary gland, due to retention of milk. It is characterized by a swelling of the whole gland or some lobes of it. The breast is fastened immovably to the chest, hard, and knotty. The skin may be paler than normal or have a slight red or bluish tinge. This condition gives rise to pain, and may be accompanied by moderate fever, but shows in other women no reaction on the general system. The most frequent causes are exposure to cold, and, next to that, a too abundant secretion. This condition may disappear from one day to the other, but it may also change into mastitis.

3. *Subglandular mastitis*, like the subcutaneous variety, develops rapidly: in from two to five days it commonly reaches the greatest intensity. The pain is deep-seated; pressure on the skin is not painful; there are no swollen nodules; the skin is only slightly red; and the whole breast appears lifted up from the thorax. This variety ends almost invariably in suppuration, and points outward and downward from the breast. I have seen a case in which an overlooked subglandular abscess perforated the wall of the chest, causing fatal pleurisy. It may also produce diffuse cellulitis of the abdomen, the axilla, and the neck, and corrode bones and cartilages.

The fluctuation is often hard to detect, and it may be necessary to ascertain the presence of pus by means of a hypodermic syringe.

Sometimes an abscess behind the gland communicates with one in front of it through a canal in the glandular tissue, so as to form a cavity of the shape of a collar-button (*abscès en bouton de chemise* of French authors).

TREATMENT.—The treatment of mastitis is prophylactic and curative. To the prophylaxis belongs the care of the nipples during the latter months of pregnancy, and the treatment of the slightest excoriation of them during lactation, as described in speaking of sore nipples. But besides these measures, directed to the nipples, others are applied to the breasts themselves. The day they begin to fill, say about three or four days after delivery, the chest of *every* patient is covered with a kind of jacket (Fig. 105) which, in all its simplicity, is the most perfect bandage

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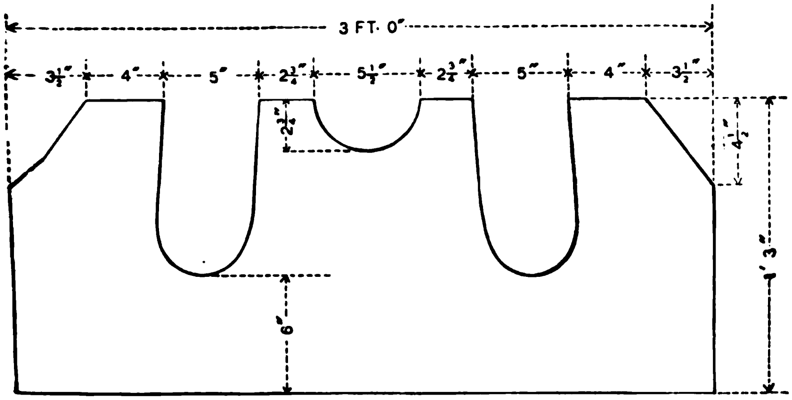
[1] Jacobus: *Amer. Journ. Obst.*, 1883, vol. xvi. p. 1259.

Fig. 105.



Miss Murphy's Breast-binder.

for the breasts I know of. I may praise it so much more freely as it is not my invention, although I have been indirectly instrumental in producing it. When I became connected with the Maternity Hospital mammary abscesses were very frequent occurrences. The routine treatment in the hospital at that time was to paint sore nipples with compound tincture of benzoin; empty overfilled breasts with pumps composed of a glass bell covering the nipple and a rubber ball to produce a vacuum in the bell; rub and knead caked breasts in a very active way; and apply linseed-meal poultices to mammary abscesses both before and after incision.

On the 1st of October, 1882, I introduced a radical change in this whole treatment, part of which was to apply an even compression to over-distended and caked breasts, instead of rubbing, kneading, and pumping. This was simply done with a piece of muslin that from the back went round both mammæ, and was pinned tightly in front and lifted up by means of shoulder-straps. In the course of time this plan has undergone an evolution which, so far as I have been able to find out, is exclusively due to our excellent head-nurse, Miss Marion Murphy. The bandage itself, with its shoulder-straps, has grown to form a kind of jacket that surrounds the whole chest without forming a fold, gives a perfectly even support to the breasts, and allows to exercise any desired degree of compression. In the hospital we have a large number of these jackets ready made and hemmed. In private practice I improvise them by taking half a yard of strong unbleached muslin one yard wide, double it up, and cut out holes for the neck and the arms.

The other improvement is in the use of this bandage. Instead of being only used when inflammation or congestion was present, it is now used on all patients, without exception, from the time the breasts begin to fill until the patients are removed to the convalescent ward; that is, from the third or fourth day until the ninth. It is pinned from below upward, the patient herself helping to bring the breasts as high upward and inward as they will go, and a piece of wadding being inserted between the two, so as to have a corresponding degree of pressure over the inner parts of them. Last of all, the shoulder-flaps are pinned together. In normal cases the binder is put on in such a way as just to give support, and is opened halfway down every time the child shall nurse.

If the child is dead and the breasts are to be dried up, they are first covered with a circular piece of lint soaked in atropin-glycerin (℞. Atropinæ sulphat., gr. j; glycerinæ, ℥j); then comes a thick layer of cotton batting, and the jacket is fastened as tightly as possible. This dressing often remains untouched for a whole week, except that the tightening is gradually increased when the breasts become smaller. At the same time the patient is given a saline aperient.

In nursing women the breasts are kept empty by one or more babies, unless sore nipples necessitate a temporary discontinuance of nursing. Then the nurse milks the breasts out in the way described above.

This treatment is so effective that we have no mammary abscesses at all. During several years I have only had one case in my service, and that was in a scrofulous subject with particular tendency to glandular abscesses, as mentioned above. Nay, even the earlier stage of mastitis has become exceedingly rare. In mild cases we do nothing except to keep the breast empty and compressed. If there are swelling, redness, pain, and fever, an ice-bag is applied to the sick part, outside of the binder, and held in place by a separate strip of muslin round the chest.

The principle of treating inflamed breasts by means of compression is an old one, and has been tried in many ways—by roller or triangular bandages, plaster strapping, bandages with plaster of Paris or paste, a rubber bag filled more or less with air or water fastened to the breasts by means of a non-elastic cover, and straps encircling the chest.[1] Salugowski has described[2] what he calls a contra-mastitis bandage, but the description is not clear, and the bandage cannot possibly exercise so even a pressure as ours, as traction is only practised in one direction. It is impossible to make the roller bandage hold. Triangular bandages give a less even compression. Plaster strips round the whole body itch, may cause eczema, erysipelas, or excoriation, are troublesome to apply, and cause pain when removed. Plaster of Paris and similar congealing or hardening substances form a very uncomfortable cuirass: soon they become too loose, and the outflowing milk soaks the wadding under them. Our bandage has the advantage over all of being simple, cleanly, comfortable, and adaptable to all cases and circumstances.

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[1] Clooten and Chassigny of Lyons: *Centralbl. für Gynäk.*, 1879, vol. iii. p. 115.

[2] *Centralbl. für Gynäk.*, 1886, vol. x. p. 400.

A question of great importance, and one often difficult to decide, is whether the child shall nurse or not, and whether the nursing shall be only temporarily interrupted or discontinued for good. When the nipples are badly excoriated it is better, in the interest of the mother, to substitute milking and compression for nursing for a few days. If they are in a good condition, and the breasts are threatened, the more the child nurses the better. If there is pus formed in a place in open connection with the lactiferous ducts, lactation must be discontinued in order to prevent the child from swallowing the pus together with the milk. When the abscess is healed and the hardness has disappeared, lactation may be resumed in strong individuals, but must be closely watched. On the reappearance of pain, tenderness, or swelling it ought to be instantly given up.

I may briefly refer to other methods of preventing the formation of mammary abscesses. The solid extract of phytolacca is spread on a cloth and kept applied to the breast which is the seat of inflammation, and the fluid extract is given internally (♏xx, t. i. d.).

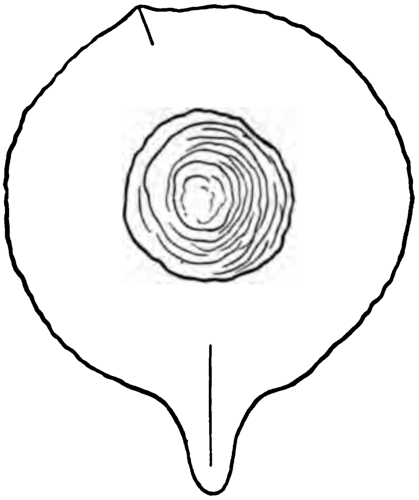
Quinine is much praised. Others recommend fomentations of hot vinegar or ointments of tobacco and camphor. The iodide-of-lead and iodide-of-potassium ointment have seemed to me to work well in some cases. To all these there are at least no serious objections. Not so with bloodletting, local or general, or blistering. Venesection entails an unnecessary waste of strength. Leeches leave disfiguring cicatrices that never disappear. Blisters are painful, irritate the nerves, disturb sleep, and may even leave a mark on the delicate skin of an organ the beauty of which is dear to most women. Blue ointment, although effective as a resolvent, is liable to cause salivation, and ought not to be used when the same end can be attained in a better and safer way by compression and ice.

If suppuration is unavoidable, it is better to hasten it by means of a warm linseed-meal poultice. When the abscess is formed, it should be opened, but as to the proper time for doing so there is a difference between the different kinds of abscesses. While the subcutaneous and the subglandular variety ought to be opened as soon as detected, it is better to let the glandular variety have time to approach the surface.

The subcutaneous variety is, as a rule, small, and one moderately long incision is all that is necessary to empty it. On account of the tension of the skin over the gland it will gape less and form a less visible cicatrice if made in the direction of a radius from the nipple to the circumference.

If the abscess is situated partly within and partly without the areola, the incision ought either to be made entirely on the areola or entirely outside of it. The reason of this is that the pigmentation is apt to follow the incision, and thus a permanent irregularity in the extension of the colored part of the breast may be left as shown in Fig. 106.[1]

FIG. 106.



Pigment of the Areola following Incisions (Richardson).

The subglandular abscess is opened where it points at the circumference, as a rule outward and downward. An incision an inch or more in length must be made parallel to the circumference of the gland, and if no counter-opening is deemed necessary a soft-rubber drainage-tube should be pushed into the depth of the cavity formed by the abscess. A small safety-pin is pushed through the end of the tube, so as to prevent it from being drawn too far in, and a little pad of cotton, lint, or gauze is placed under the pin in order to protect the skin from pressure.

The glandular variety, as a rule, requires two or three openings in order to ensure good drainage, but they need not be more than half an inch long.

In order to avoid the lactiferous ducts they ought to be made in the direction of a radius from the nipple to the circumference. From the first opening a probe is carried as far as possible through the abscess, and a new incision is made by cutting down on the end of the probe, which is left in place to serve as a guide in introducing drains.

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[1] W. L. Richardson: *Trans. Am. Gyn. Soc.*, 1876, vol. i. p. 165.

The best drain is a bundle of horse-hair, which for this purpose is washed with soap and water and disinfected with bichloride of mercury, creolin, or carbolic acid. The bundle is pulled through from one opening to the other by means of a long blunt needle with a large eye, and tied loosely over the breast. If horse-hair is not to be obtained, silk may be substituted. Soft-rubber drainage-tubes may also be used, but they cause more pain to insert if it is done without an anæsthetic. The drains are left in as long as there is any discharge. If there is only one opening, it is best to shorten the tube gradually.

Before opening the abscess the skin is washed with soap and water and an antiseptic fluid. The instruments are kept in a solution of carbolic acid, and after opening the abscess it is washed out with a similar solution or creolin (2 per cent.).

Finally, the breast is covered with large pledgets of absorbent cotton or prepared gauze wrung out of the disinfectant fluid. Outside of them comes a layer of oil-silk, oil-muslin, or gutta-percha tissue, and at last the breast-binder, sufficiently tightened to keep up a moderate pressure. The dressing is changed once a day, and at the same time the tubes and cavity are cleansed by injecting a little antiseptic fluid. Tonic remedies, especially quinine and iron, are given internally. By this treatment even a large abscess heals in a week or ten days.

Some women are so averse to the use of the knife that it may be hard to obtain their permission to have recourse to it. The subcutaneous, and especially the subglandular, variety of abscess ought to be opened without compromise, as there is real danger of their spreading far out or penetrating to deeper parts. As to abscesses situated in the gland itself, it is perhaps not so absolutely necessary to open them, but the patient ought to be made to understand that the process, if left to itself, is much longer, that the abscess acquires unnecessarily large dimensions, that more of the gland is destroyed, that there is more danger of its spreading to the subcutaneous or subglandular tissue, and—what will perhaps weigh more with her than any other consideration—that the scar will be more conspicuous.

The pain of the incision may be much lessened by the previous injection of cocaine, whereas the use of Richardson's ether spray has not seemed to me to give any considerable relief. As the necessary procedures are often quite painful, there may be indication for the induction of general anæsthesia.

In old, neglected cases there may be deeply-situated abscesses which cannot be reached except through a considerable mass of glandular tissue, an incision through which might cause dangerous hemorrhage. Under these circumstances the best treatment is to make an incision through the skin, the subcutaneous fat, and the fascia. When the gland is exposed a pointed director is thrust into the abscess, and a slender pair of forceps is pushed along the groove of the director until it enters the cavity of the abscess. Then the blades are forcibly separated, so as to give exit to the pus, and a drainage-tube is introduced between the blades.

Congestion of the mammary gland is treated by emptying it and applying even compression in the way described.

If hard nodules remain after mastitis, they are treated with resolvent ointments, such as ung. hydrargyri or ung. potass. iodidi. If the child is weaned, the iodide of potash may be administered internally at the same time. The galvanic current has likewise proved beneficial.

Fistulæ will be considered separately.

COLD OR CHRONIC ABSCESS OF THE BREASTS.

Besides the common acute abscesses described on the preceding pages, sometimes chronic or so-called cold abscesses are found in the breasts in connection with lactation. They are commonly subglandular. Sometimes they begin like an acute abscess, but the pain soon subsides, and the swelling increases very slowly during three weeks to two months. Sometimes pain is absent altogether. Such abscesses may be found in otherwise healthy women without scrofulous or tuberculous diathesis.

TREATMENT.—If the abscess is large, several small incisions and drainage are the best treatment. If they are small, they are laid open from end to end. In both cases the local use of tincture of iodine promotes their healing. Compression and dressing are used as for acute abscesses.

SWELLING AND MILK RETENTION IN THE AXILLA.

In a certain number of cases I have seen a swelling appear in both axillæ of puerperal women which closely simulates an abscess, but is caused by the formation and retention of milk in accessory mammary tissue placed in this locality. These swellings are painful, tender to the touch, covered with normal or pink skin, and often divided in two parts by a sulcus. They may show a distinct fluctuation, and the first time I observed these swellings I came very near plunging a bistoury into them; but by means of a hypodermic syringe I satisfied myself that they contained only pure milk. In spite of the most careful palpation, I have not been able to feel any connection between them and the mammary gland.

When treated with a thick layer of compound iodine ointment they disappear in a few days. I have never seen any suppurate.

MASTITIS OF THE NEWBORN.

It is not rare to see the mammary glands of newborn children, male as well as female, become hard, tender, and swollen a few days after the birth of the child. A white fluid can be pressed out of them, which chemically and microscopically is like colostrum.[1] As a rule, this swelling is easily scattered, but sometimes suppuration intervenes, and the pus may then perforate the capsule, spread under the skin, and cause considerable destruction of the connective tissue. Under these circumstances the inflammation may be accompanied by high fever and great prostration, and may even end fatally.

TREATMENT.—As a rule, a linseed-meal poultice covered with oil-silk and a bandage round the chest produces resorption in a few days. If pus is formed, the abscess should be opened with a lancet, washed out, and dressed with carbolized water or creolin (1 per cent.). If there is diffuse cellulitis, several incisions, drainage, and removal of dead connective tissue may be necessary. At the same time, the patient should have a teaspoonful of a mixture of one part of brandy with three parts of water and a little sugar every one or two hours, and one grain of quinine three times a day.

FISTULÆ OF THE BREASTS.

There are two kinds of fistulæ of the breasts: one is simply a remnant of an abscess which has not closed, and is mostly found in the gland or behind it, rarely under the skin. The other is a milk fistula, a fistulous tract leading from the skin to a lactiferous duct. These may likewise have originated as a common abscess which has corroded a lactiferous duct, but they may also result from a wound by which such a duct was severed, which wound is kept open by the continual flow of milk through the artificial aperture. The fluid that comes from such a fistula may be pure milk or milk more or less mixed with pus. Such old fistulous tracts may constitute a serious drain on the constitution and cause tuberculosis of the lungs.

TREATMENT.—If the patient nurses, she should, if possible, wean the child. Sometimes compression will cause the closure of the fistula; in other cases this is obtained by means of astringent and irritant injections, especially tincture of iodine undiluted or nitrate of silver (2 per cent.), used in small quantities twice a week, or carbolic acid (2 per cent.), used daily in large quantity. Jacobus[2] praises Villate's solution (℞. Sulphate of copper, sulphate of lead, *āā.* 15 parts; sol. subacetate of lead 30 parts; vinegar 200 parts[1]), mixed with two parts of water, or still more Labarraque's solution (Liq. sodæ chlorinatæ, U. S.), one part to eight or ten of water, used two or three times a day. In desperate cases it may become necessary to split the whole breast, or at least to make more or less large incisions combined with curetting by means of Simon's sharp scoop.

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[1] Filatow: *Centralbl. f. Gynäk*, 1879, vol. iii. p. 374; Opitz: *Ibid.*, 1882, vol. vi. p. 170.

[2] *Loc. cit.*, p. 1266.

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[1] Bartholow: *Materia Medica*, 6th ed., 1888, p. 302.

THE ETIOLOGY OF PUERPERAL FEVER.

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Boston.

In considering the cause of such a disease as "puerperal fever," so called, it is utterly impossible at the present day to get a proper grasp of its meaning and true nature if all the recent investigations into the nature of infectious diseases are not considered at the same time.

The problem before us is to study and to understand, as far as is possible, what is the cause and nature of those acute febrile and inflammatory processes following childbirth and occasionally coincident with it.

Are these changes—more often seen in places where there are collections of parturient women, but not by any means confined to such localities—are these changes due to a morbific principle generated within the victim herself, or does the virus come from without? And how is it, if the first be true, that some women are affected and others not? If the second hypothesis be the right one, what are the circumstances governing the entrance and distribution of the virus into the human body, and what is the nature of that virus?

In order to obtain a more complete understanding of the ideas to be expressed in this paper, a summary of the position it is desired to support will be useful, accompanied by a discussion of the various theories in regard to the processes under consideration that have been held very generally, and are held to-day, by a certain proportion of medical practitioners.

In the light of the revelations of modern science it seems possible to make the following statements, and to support them by evidence as conclusive as can be brought to bear upon medical subjects: 1. Puerperal fever, so called, is not, contrary to the opinion so widely held at one time, more especially on the continent of Europe, a specific disease peculiar to women in the lying-in condition. It is allied to, and in fact is exactly similar to, any other of the septicæmic or pyæmic conditions with which medical men have to deal, and which arise more commonly in connection with surgical affections, and are sometimes said to occur "idiopathically." 2. The disease is not in any sense "specific." It is due to the activity of the lower forms of life included under the general head of "micro-organisms;" and there are a number of these micro-organisms which, introduced into the body under favorable conditions, may give rise to symptoms to be classed under the general head we are considering. 3. The cause of these symptoms is never developed in the body of the affected woman. The normal course is recovery without disturbance of the animal economy, and any variation from this course must be ascribed to the introduction of some powerful disturbing influence from without. 4. It does not necessarily require the growth of micro-organisms within the body to produce this result, although this is almost invariably the case; but the introduction of the products of this growth—the ptomaïnes or the leucomaïnes—may produce the changes to be observed, although these products do not and cannot occur without the previous growth of the organisms which give rise to them; so that the symptoms may be due to a double cause: the growth of the bacteria and the overwhelming of the system by their numbers, or the toxic effect of the alkaloids produced in the course of their growth; and these two influences may act independently or together. 5. As a corollary it follows that if the morbific principle be kept out of the body, no disturbing reaction will occur; that the channel of entrance is most commonly through the genital tract; and that the carrying agent is unquestionably very commonly the infected hands or instruments, introduced wantonly or of necessity into the vagina or uterus at a most receptive stage of their existence. There is not much of the mysterious in the matter, and no necessity for supposing the intervention of an angry Providence in order to avoid the consequences of individual responsibility. The attendants are usually the ones responsible for the occurrence of the untoward symptoms.

These opinions are widely distinct from, and opposed to, those held not so very long ago by many of the most prominent obstetricians of the day; but that they are the legitimate conclusions from all the work done upon etiological science—especially in the last ten years—seems to be easy of proof. Certain things must be taken by analogy, and the analogies and proofs in this case are so numerous and convincing that doubt appears to be impossible.

Puerperal fever has been known from the earliest times of historical medicine; that is to say, the ancient authorities speak of the liability of the lying-in woman to disease and death of the nature of blood-poisoning. The real history of the disease, together with the discussion upon its nature and causes, began less than a century ago, when the occurrence of the epidemics in lying-in hospitals in England and upon the continent of Europe attracted attention to it and gave rise to the discussions which are hardly ended to-day. To the English observers is due the credit of having first come to something of a realizing sense of the true nature of the affection, so far as its infectious properties are concerned, whilst upon the Continent, more especially in France, the possibility of its direct communication to a lying-in woman by a human agency was denied long after the accumulation of clinical facts would seem to have rendered such doubt impossible. That the nature of the affection was understood in this country half a century ago is very well shown by the vigorous and convincing paper of our own Dr. Holmes upon *The Contagiousness of Puerperal Fever*, first published in 1843. From the clinical side the arguments brought forward and the authorities quoted in this paper furnish an overwhelming mass of evidence in favor of the infectious nature of the disease, and yet it was unconvincing to some of those who should have been best in a position to see the truth. As now published,[1] the headings of this paper stand thus: "The point at issue—the affirmative: the disease known as puerperal fever is so far contagious as to be frequently carried from patient to patient by physicians and nurses."[2] The negative: "The result of the whole discussion will, I trust, serve not only to exalt your views of the value and dignity of our profession, but to divest your minds of the overpowering dread that you can ever become, especially to woman under the extremely interesting circumstances of gestation and parturition, the minister of evil—that you can ever convey, in any possible manner, a horrible virus so destructive in its effects and so mysterious in its operations as that attributed to puerperal fever,"[3] "in the propagation of which they have no more to do than with the propagation of cholera from Jessore to San Francisco and from Mauritius to St. Petersburg."[4] "I arrived at that certainty in the matter that I could venture to foretell what women would be affected with the disease upon hearing by what midwife they were to be delivered or by what nurse they were to be attended during their lying-in; and almost in every instance my predictions were verified."[5] "A certain number of deaths is caused every year by the contagion of puerperal fever communicated by the nurses and the medical attendants."[6] "Boards of health, if such exist, or without them the medical institutions of a country, should have the power of coercing or of inflicting some kind of punishment on those who recklessly go from cases of puerperal fever to parturient or puerperal females without due precautions, and who, having been shown the risk, criminally encounter it, and convey pestilence and death to the persons they are employed to aid in the most interesting and suffering period of female existence."[7] "We conceive it unnecessary to go into detail to prove the contagious nature of the disease, as there are few if any American practitioners who do not believe in this doctrine."[1]

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[1] *Collected Works*, 1888, Houghton, Mifflin & Co., volume of "Medical Essays."

[2] O. W. Holmes, 1843.

[3] Prof. Hodge, 1852.

[4] Prof. Meigs, 1854.

[5] Gordon, 1795.

[6] Farr in *Fifth Annual Report of Registrar-General of England*, 1843.

[7] *Copland's Medical Dictionary*, art. "Puerperal States and Diseases," 1852.

This, then, was the position of things forty years ago: the majority of clinical observers insisting upon the essential infectious nature of the disease, whilst some of the most eminent teachers of the day were opposing these assertions in words to which their positions and experience would naturally lend added weight and power. So far were these gentlemen carried that they were able to see nothing in the experience of Dr. Rutter, a contemporary of theirs, and which may be found in *The Quarterly Summary of the Transactions of the College of Physicians of Philadelphia*, for May, June, and July, 1842. Here, Dr. Condie spoke of the prevalence of puerperal fever of a peculiarly insidious and malignant type: "In the practice of one gentleman, extensively engaged as an obstetrician, nearly every female he has attended in confinement during several weeks past, within the above limits (the southern section and neighboring districts), had been attacked by the fever;" and Dr. Rutter, the practitioner referred to, said that after the occurrence of a number of cases of the disease in his practice he had left the city and had remained absent for a week, but on returning, no article of clothing he then wore having been used by him before, one of the very first cases of parturition he attended was followed by an attack of the fever and terminated fatally. He cannot readily, therefore, believe in the transmission of the disease from female to female in the person or clothes of a physician. This was on May 3, 1842, and in a later letter[2] he speaks of his experience of the disease, now numbering nearly seventy cases, all of which have occurred within less than a twelvemonth past, and yet he could say, as quoted above, that he "cannot readily believe in the transmission of the disease from female to female in the person or clothes of a physician." To us, at this distance of time, the explanation of the occurrence in a single individual's practice of so great a number of cases seems difficult to find, although modern ideas would certainly not permit the plea of a "coincidence" to be offered. But the complete history of the circumstances of the case is not given here, and when it is known the occurrences become easy to understand.

Dr. Rutter was suffering, during all this time, from an ozæna acquired from a neglected pustule following inoculation upon the index finger, and unquestionably carried the source of the inoculation of his patients with him. This source being unrecognized, all the changes of clothing or absences from the city he chose to go through with would do no good whatever.

This instance is spoken of at length as being one of the most striking and celebrated, but many others are recorded where puerperal affections have followed the path of single individuals from childbed to childbed, whilst no doubt hundreds more have occurred which have never been put in print.

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[1] Dr. Lee, in additions to article last cited.

[2] *Med. Exam.*, Dec. 10, 1842.

When the evidence that has been accumulated upon this point is summarized and reviewed, and fails to carry conviction that, clinically speaking, puerperal fever is communicable to the patient by physicians or nurses, the state of mind refusing such evidence can only be compared to that in Watson's simile: "A man might say, 'I was in the battle of Waterloo, and saw many men around me fall down and die, and it was said that they were struck down by musket-balls; but I know better than that, for I was there all the time, and so were many of my friends, and we were never hit by any musket-balls. Musket-balls, therefore, could not have been the cause of the deaths we witnessed.' And if, like contagion, they were not palpable to the senses, such a person might go on to affirm that there existed no proof of there being any such things as musket-balls."

Evidence like that given above, derived from the collection of observed and recorded facts, was all that could be offered at the time to show what the true nature and cause of puerperal fever might be. The exact methods of modern research were then unattainable: the microscope was in existence, to be sure, but its form and power were absolutely unadapted to the researches that have since been conducted by its aid.

The very idea of the activity of the micro-organisms as factors in disease was scouted by most observers, and the theory of spontaneous generation had not yet received its deathblows. The rough form of investigation—the inoculation of morbid materials into healthy animals—had been practised to a certain extent, and to experiments of this nature by Semmelweis in 1847 are owing the first real steps in the knowledge of puerperal fever and its connection with other forms of septicæmia and pyæmia.

By using the term "rough form of investigation" it is not meant to detract from the value of such investigations or to lessen the credit to the observers who employed them. The desire is merely to emphasize the difference between the means for close observation at that time and those at the command of all scientists who choose to employ them to-day. The development of these means is of such recent date that it is hardly ten years since they were used at all, and less than five since their employment became general; and yet it is to these methods and instruments that we owe the bases of the assertions forming the theories given in this paper.

Just ten years ago the researches into the nature of the septic poison had reached such a point only that a cautious observer used such words as these in stating his views upon the nature of puerperal fever: "As to the precise character of the septic poison, although of late much has been said about it, and there is good reason to believe that further research may throw light on this obscure subject, too little is known to justify any positive statement. With regard to the influence of the minute organisms known as bacteria this is especially the case. Heiberg has proved that they may be traced, in most cases of puerperal septicæmia, passing through the veins and lymphatics, and that they are found in various organs and pathological products; but whether they themselves form the septic matter or carry it, or whether they are mere accidental concomitants of the pyæmic process, it is impossible, in the present state of our knowledge, to state, and I therefore prefer to dwell on that part of the subject which is of clinical importance, rather than enter into speculative theories which to-morrow may prove valueless."[1] That "to-morrow"—proving the valueless weight of the importance attached to the micro-organisms as factors in the production of disease—has never come; but, on the other hand, since that time there has been almost daily evidence put forward in support of the most advanced claims at first made for the etiological properties of these minute forms of life.

The reasons for this extremely rapid advance in our knowledge of the life-history and pathological properties of the micro-organisms are not difficult of comprehension if one knows the facts, and lie in the application to scientific investigation of three means of study, first worked out and systematized, so that the scientific world might use them, by that master of close reasoning and painstaking research, Robert Koch, now of Berlin. These three means of study were: in the first place, the application of aniline dyes to histological methods. As soon as these dyes were used in commerce, it was found that they would be of value in the study of minute anatomy, for the reason that they had an especial power of deeply staining cell-nuclei and bacteria, leaving other portions of the tissue unstained, or else being easily removed from those tissues upon the employment of simple decolorizing agents. This property, possessed by most of these aniline colors, was of the greatest importance, of course, because micro-organisms are so small that, being for the most part without pigment, they are exceedingly difficult of detection unless especially stained; and a method of special staining, generally applicable, had been wanting up to the time of the introduction of these products of coal-tar distillation. This, then, was the first step—the staining of bacteria with aniline dyes. The second was of equal importance, and consisted in the successful application to the construction of the microscope of certain laws of optics, the introduction of the homogeneous immersion lens with its wideangled aperture and its straight rays from the object through the immersion medium and objective to the eye, and the use of Abbé's sub-stage illuminating apparatus, this consisting of a series of lenses, flat on top, convex beneath, placed between the mirror and the object, and throwing a flood of light upon the field of vision from below. This flood of light serves to drown out the faintly-stained structure-picture almost entirely, leaving to be seen only the deeply-stained cell-nuclei and bacteria; and this result is of the greatest possible value, because it often happens, where but few bacteria are present, that they are obscured by the details and lines of the structures containing them, whereas they come at once and distinctly into view when measures are taken for drowning out the structure-picture and leaving only the color-picture of the field of vision.

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[1] Playfair's *Midwifery*, ed. 1878, p. 581.

These methods were applicable to the simple discovery of the presence of bacteria, if present; but much more was necessary before a knowledge of their action in regard to the processes in which they were found could be obtained, and a surer means of their study outside of the body needed to be discovered. The suggestion of such a means formed the third great step: this is due solely to Koch's genius, and consists in the methods of isolation and pure-cultivation in solid nutrient media so widely employed to-day. Not that there had not been pure-cultures obtained before; but these had all been in fluid media, and the intimate mixture and changing positions of the organisms contained in these fluid media made it utterly impossible to differentiate species unless there was a marked difference in form. This impossibility of differentiation was the reason that the term "micrococcus of pus" was used so long; and the investigation of pus by the method of examination in solid culture-media is the reason for the disuse of this term, and the acquisition of the knowledge that there are so many varieties of pyogenic micrococci with very similar morphological properties, but distinctly different pathogenic powers. Therefore it is that by reason of these three advances in methods of scientific research—aniline dyes, improved lenses and illumination, and solid culture-media—our whole knowledge of the place of the micro-organisms in disease has become developed and assured; and with that knowledge our conception of pyæmia and septicæmia and allied processes has necessarily undergone a complete change. The place of bacteria in the production of disease is to-day unquestioned, and more especially in connection with these very processes of septicæmia and pyæmia: in regard to them there is but the one opinion, that they are essentially "bacterial" diseases, produced by the activity of these low forms of life, and the direct result of that activity occurring in the body, or of its products resulting from their growth in or out of the body.

As a necessary preliminary to the belief in the assertion that bacteria are the causes of the diseases in which they are found, it would be necessary to show that the human body does not, in health, contain any of the lower forms of life that are in question. This has been done again and again, and under properly conducted experiments it has always been found that the internal animal economy is absolutely free from any forms of life that the means at our command will enable us to detect. The skin and mucous membranes are at all times, in health and disease, covered with various forms of organic life that are revealed to us by staining, microscopic examination, or culture-methods, but the internal organs not.

In health the blood contains no bacteria of any kind, and the same is to be said of the liver, spleen, kidneys, muscular tissue, etc. In disease, however, the condition of things is very different, and in this case bacteria of many kinds are found in the lesions occurring in the course of the affection under consideration, and more especially and frequently in the acute febrile processes exercising a general influence over the animal economy. Here, then, is the question: In pyæmia and septicæmia are always found bacteria—are these bacteria the cause of the disease or not? The older definitions—and not so very old—of these two affections are as follows: "*Pyæmia.* Purulent contamination of the blood, producing marked depression of the vital powers, the formation of abscesses in various regions of the body, etc., constituting the *Diathesis seu infectio purulenta—Purulent contamination diathesis, Purulent infection.* It is supposed by some to be due to suppurative capillary phlebitis; by others, to coagulation of the vitiated blood in the vessels—the veins especially—or the heart, and to the inflammation and suppuration developed by the clots when detached and carried into the capillaries of other parts."[1] "*Septicæmia.* Putrid infection. A morbid condition of the blood produced by septic or putrid matters—animal poisons especially—the inhalation of foul air or septic gases. It resembles pyæmia in its symptoms: the latter may be regarded, however, as a purulent infection; septicæmia as a putrid infection."[2] This shows the broad distinctions and similarities between the two processes at the time of the beginning of bacteriological researches as at present conducted, and offers as clear an idea of the state of medical opinion as could well be given. The great change in the ideas held to-day is unquestionably the result of work done within fifteen years, and the special beginning was marked by the publication of Koch's work on *Wundinfektionskrankheiten.* Here the problem was first clearly stated, and the fact made patent, that these terms (septicæmia and pyæmia) cannot be held to have any significance whatever as indicating specific diseases, but that they must be considered as words used for convenience to denote clinical symptoms somewhat allied. It is not necessary, therefore, to discard them at once and for good; but it is of great importance to remember that their meaning is only clinical, and that the symptoms indicated by them are the result of many causes acting separately or together; that is to say, that the symptoms are produced by one or more varieties of bacteria acting together or separately, and that a scientific nomenclature to-day requires that the cause of the symptoms observed in the individual case shall be called by the name of the bacterium or bacteria active in producing them. Pyæmia does not arise from the entrance of pus into the blood-veins, and septicæmia is not putrefaction of the living blood.

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[1] *Dunglison's Med. Dict.*, ed. 1874.

[2] *Ibid.*

For a long time pyæmia was distinguished from septicæmia by the occurrence of metastatic deposits in the former and their absence in the latter. But since it has been established that even in such cases as had previously been described as septicæmia isolated microscopic metastatic deposits are not infrequently present, and that the two processes cannot be definitely separated in this way, some authors have preferred to designate as septicæmia the disease brought about by absorption of dissolved putrid poison, and to call all the other morbid processes connected with the development of microscopic organisms pyæmic processes. Birch-Hirschfeld,[1] for example, separated pyæmia from septicæmia in this way. He understood by the term "septicæmia" a disease originating in alterations of the blood, which alterations were a consequence of the absorption of the products of putrefaction. On the other hand, he defined pyæmia as a "general infection," which proceeds from the surface of wounds or from the forms of a primary suppurative inflammation probably evoked by specific organisms and different from the putrid infection. Cohnheim[2] also identified septicæmia with putrid infection, and attributed it to the entrance of a putrid poison in solution into the fluids of the body. Davaine adhered, on the other hand, to the older distinction between pyæmia and septicæmia, and included under the latter term all those cases in which post-mortem examination shows no metastatic deposits, although in both cases he considered the co-operation of specific organisms as proven.

In order to justify the assertion that such diseases as pyæmia and septicæmia are produced by living organisms, and not dead matter, and that these organisms are introduced from without, and do not develop *de novo* in the living tissues in which they are found, a line of reasoning and experimentation somewhat as follows is necessary:

1. Bacteria must be proved not to occur in the healthy animal tissue.

2. The methods of introduction of the micro-organism into the body

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[1] *Lehrbuch der Pathologischen Anatomie*, Leipzig, 1876, p. 1224.

[2] *Vorlesungen über Pathologie*, Berlin, 1877, S. 469.

must be shown, and their etiological relationship to the processes accompanying their presence must be proved.

3. These micro-organisms must be proved not to be capable of self-production; that is to say, that the old doctrine of *omnis cellula e cellula* must be reaffirmed, and supported by evidence obtained from the modern exact methods of research.

1. The first question is settled by an enormous number of experiments; and it is known that in health no micro-organisms are found in the tissues of the animal body. Observation of blood and organs, every known precaution against the accidental introduction of bacteria being taken, have shown repeatedly the truth of this fact; so that its acceptance is perfectly justifiable upon the evidence presented.

2. Therefore it is but a truism to say that, the presence of bacteria being coincident with disease, they must have some relation to it, and that that relationship may be an active or a passive one. And this is, of course, the especial point upon which so much difference of opinion has been expressed, as to whether this relationship is one of cause or simply one of accompaniment of the pathological process. In the first place, what are the probabilities? All clinical experience, properly interpreted, shows, as has been stated before, that certain affections classed under the heads of pyæmia and septicæmia are infectious; that is, that they may be, and are, communicated from patient to patient. Now, the nature of the cause of these affections must be one of two: it must be either dead, incapable of reproduction ("chemical"), or it must be living; it must be capable of increase in some way of self-reproduction; and we can form no conception of anything that can do this sort of thing except those lowest forms of life known as micro-organisms or something still higher in the scale of animated nature. That the poison is not chemical in the first instance we are justified in concluding by analogy. All we know of pure chemical action shows this. A toxic dose of arsenic is toxic for the individual alone; the same effect can only be produced with the same poison by the extraction of the entire quantity from the body of the person to whom it was first given. No increase of the amount over the dose first given is ever found to occur, and the division of the original dose results simply in a proportionate diminution of the amount of change produced, and never under any circumstances in an increase or equalling of the changes arising from the whole of the original amount. On the contrary, a living ferment is capable of constant and indefinite reproduction and increase, provided proper conditions for its development be present, and we are forced to the acceptance of the conclusion that this is the nature of the poison concerned in the reproduction of epidemics of disease such as those we have under consideration. If their cause were chemical simply, there would be but one case, and there an end;

but, as this limitation of the disease does not—or rather did not—usually occur, it is not possible to grant their simple chemical origin.

That the cause is something more than a chemical agent, and these diseases something besides simple chemical reactions, have been proven, however, in a much different and more forcible way than by the mere force of analogy. Experimentation has been called in by numerous and capable observers, and we are able to say to-day of suppurative and allied processes that these do not occur without the precedent activity of micro-organisms. Of these experiments only a few can be mentioned, but they will serve to show the direction and methods pursued in them all. Before our knowledge of bacteriological methods was as precise as is now the case, such experiments as those of Councilman[1] and others were considered to be conclusive. These experiments show, or seem to show, that the introduction of simple irritant substances into the animal tissues was sufficient to set up a more or less marked degree of irritation, followed by suppuration and the production of a localized or sometimes of a general purulent process. The materials used were croton oil, turpentine, and the like, and the results observed after their introduction into animals were ascribed to a specific power which they possessed, which could, and generally did, produce pus-formation when such materials came in contact with animal tissues. These experiments did seem to be conclusive at the time they were published, but with our more recent and intimate knowledge of bacteria their fallacies are easily to be perceived, and are seen to lie very largely in the imperfect methods taken to prevent the activity of bacteria, and the fact that these latter were not sought in the lesions produced by means which would lead to their detection if present. It is not surprising, therefore, to read the results of Klemperer in his admirable article upon this subject.[2] Thinking, and with apparently good reason, that the results of other observers might be due, in part at least, to the imperfect sterilization of the skin of the animals experimented upon, this author made all his inoculations at a point which had been just previously seared with a hot iron, and again used the actual cautery at the point of inoculation after the operation was over. Of course the syringe and material employed were thoroughly sterilized in the usual way. Experiments were made in large numbers with acids, alkalies, cantharides, mustard oil, petroleum, and other irritating materials, and upon rabbits, guinea-pigs, and mice. Pus-formation never occurred: at the most, the only sign of any local or general disturbance was a moderate localized serous effusion. After the use of croton oil or mercurial injections there occurred in some cases a firm necrotic (diphtheroid) infiltration—Weigert's "acute coagulation necrosis." In only three of a large number of cases did suppuration occur, and in all of these cases micrococci were found in the pus, and the observations were therefore considered imperfect. The observer concludes that the strongest chemical cannot produce suppuration without the presence of bacteria; and his results certainly seem to support this view. He found also a micrococcus which, under ordinary circumstances, would produce no suppuration upon inoculation into animals, but which would set up a flow of pus if an irritation were produced, such as would result after the introduction of acrid materials into the tissues. A most interesting set of experiments were conducted by Scheuerlein,[1] who also investigated this question, and came to the same conclusion as Klemperer, that no suppuration will occur without the presence of micro-organisms. His method was a little different and more exacting, and the results are therefore more interesting and important. He placed from one to four drops of the irritating substance in capillary tubes. These tubes were then sealed, sterilized, and introduced under the skin of rabbits with all possible germicidal precautions. When the incision made for their introduction was thoroughly healed, taking six days as a rule, the tubes were broken under the skin, and the animals were killed in from four to eight days. Thirteen irritating substances were used, such as oil of turpentine, croton oil, oil of mustard, ipecac, tartar emetic, formic acid, etc., with distilled water as a control. In only one case was suppuration observed, and bacteria were found in this one.

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[1] *Virchow's Archiv*, Bd. xcii. p. 217.

[2] *Zeit. f. klin. Med.*, Bd. x. S. 198, and *Fort. d. Med.*, 1886, S. 34.

These experiments and others like them seem to show conclusively that no suppuration, local or general, and no general septicæmic or pyæmic results, could be obtained by the introduction of ordinary irritant substances into the animal economy—that any resemblance to a suppurative process was localized, provided bacteria were excluded, and was not true suppuration at all, as shown in Klemperer's paper. And these facts have become so firmly established that it will need careful study before the results announced by Christmas[2] are accepted. Before him the experiments spoken of above had of course been subjected to much criticism, and many attempts had been made to show their lack of conclusiveness. Councilman's experiments have already been referred to, and, although he asserts that he obtained small abscesses about the fragments of the glass capsules containing the irritating substances, but found no bacteria, the lack of culture-experiments in his work destroys the force of the assertion. Orthmann and Uskoff[3] claimed that oil of turpentine and mercury, if injected under the skin of a dog, would produce profuse suppuration without the presence of bacteria. And Grawitz and De Bary[4] obtained similar results, showing that corrosive sublimate, alcohol, acids, and alkalies cannot produce abscesses, but that the injection of strong doses of nitrate of silver or essence of turpentine under the skin of a dog does produce a purulent suppuration without the presence of bacteria. Grawitz also[1] announces experiments with cadavérine, a result of bacterial growth, which he says will produce suppuration as quickly as would the introduction of the organism that gave rise to it.

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[1] *Von Langenbeck's Arch.*, Bd. xxxii. Heft 2.

[2] *Ann. de l'Institut Pasteur*, Sept., 1888.

[3] *Virch. Arch.*, xc. 579, and *ibid.*, lxxxvi. S. 510.

[4] *Ibid.*, cviii. S. 67.

The question would seem, therefore, to be far from settled, excepting that this criticism of all these experiments should be made: that they were not conducted with all the precautions against contamination that researches in this field require, and that it is not made sufficiently plain that the so-called suppurative processes themselves were exhibitions of true pus or no, and that the pus was searched with sufficient thoroughness and by the best microscopical and cultivation methods. Therefore they were not allowed to overbalance the more positive evidence that suppuration and septicæmic processes in general are produced by the activity of the micro-organisms, and the discrepancies in the results obtained by the two sets of observers were set down to faulty methods, these faulty methods being naturally supposed to lie on the side producing the least evidence of acquaintance with and employment of the exacting details of modern research. Matters stand thus to-day, and the advocates of the bacterial origin of diseases of a suppurative, pyæmic, or septicæmic nature are not ready to accept any assertions denying such origin until all the requirements they ask of themselves to prove the presence and activity of micro-organisms have been fulfilled by those who would deny their presence. This, it is to be said, is not often done, and observers are apt to forget that whilst the assertions of skilled bacteriologists are only made after long and careful research—so long and careful that one who has not tried it knows nothing about it—on the other hand, their opponents have been permitted to make assertions and conclusive arguments from facts drawn from any source rather than that of exact knowledge. The matter stands, therefore, that the etiological rôle of the micro-organisms in the production of the processes under consideration is undisputed: that they are always a factor is denied by many, by reason of observations based upon what must be called imperfect methods. These observations have been unsupported by any trustworthy evidence—by that meaning evidence obtained under rigid bacteriological rules—until the recent appearance of the paper by Christmas spoken of above; and this, if true, may contain the solution of the difficulties, but will certainly require the confirmation of independent and competent observation before it can even be accepted as true, although the observer himself has already shown powers of accurate observation. But matters have come to such a pass in regard to bacteriological work that one must not only be on one's guard against accepting conclusions based upon insufficient evidence, but the best observers' work must receive ample confirmation before it can be fully accepted by the cautious reviewer. However, the work can speak best for itself. Christmas tried a number of irritating substances in different ways. One set of experiments consisted in the injection under the skin of one-half a cubic centimeter of such materials as essence of turpentine, mercury, petroleum, chloride of zinc in 10 per cent. solution, glycerin, and nitrate of silver in 5 per cent. solution, with a uniformly negative result, except once out of thirty experiments. In this one case, after inoculation with turpentine, there did appear a true suppuration, but cultivation-experiments showed the presence of the Staphylococcus pyogenis aureus; in all the other cases the substances introduced disappeared or were absorbed after varying lengths of time and in different ways. The second set of experiments was the inoculation of the same series of substances into the anterior chamber of the eye. The result, with a dose of two drops, was absolutely negative in all the cases, except with mercury. All the other substances were absorbed with varying symptoms except mercury, which, while having an energetic local action upon the eye, produced also as true a suppuration as if bacteria had been present, and yet neither the microscope nor cultivation-experiments revealed the presence of bacteria. These experiments with mercury he repeated many times, and always obtained precisely the same results; and the regular development of pus around the mercury, the slow increase in its amount, the acute inflammation of the conjunctiva, the arrest of the suppuration when the mercury is so surrounded as to lose its pyogenic action,—all seem to prove to him that the suppuration is non-bacterial in origin. Thus far, however, he seems to have obtained no very distinct or impressive results, but his work in the next class of cases (upon dogs) seems to have been more conclusive. Using the same substances—especially nitrate of silver, essence of turpentine, and mercury—he obtained very considerable suppuration. He selected the three substances mentioned, because they are the ones which have given rise to the most discussion, and his desire was to prove the chemical nature of suppuration rather than to give a complete list of all the materials which might produce it. The details of the operation are claimed to have been carried out with the greatest rigor, and complete microscopic and culture examinations were made. The nitrate of silver and essence of turpentine were carried to ebullition before being used, and the mercury was raised to 150° Cent. All of these substances produced true abscesses, but there were no bacteria to be found; and he says that the conclusion is to be reached, therefore, "that bacteria also bring on suppuration by producing chemical alterations under the direct or indirect influence of the substances which they produce." A pyogenic substance has been found in cultures of the Staphylococcus pyogenis aureus, because the bouillon in which it has been grown, after being raised to 100° Cent.—a temperature which destroys the organism—will produce subcutaneous abscesses in dogs and in the anterior chamber of the eye in rabbits, although the sterility of the bouillon after boiling, so far as the bacteria are concerned, is proven by making cultures of it in other nutrient media. By filtering a similar culture in bouillon through Chamberland's filter a liquid is obtained which produces œdema of the conjunctiva and a slight suppuration in the anterior chamber of the eye of a rabbit. Precipitating the filtered liquid with alcohol, an abundant precipitate of albuminous substances is obtained. If this precipitate be filtered out, washed thoroughly with alcohol, and then made into an aqueous solution, it will give precisely the same results as the filtered culture upon inoculation into the eye of rabbits—*i. e.* œdema of the conjunctiva, discoloration of the iris, and slight suppuration of the anterior chamber. This substance resembles the diastase of Arloing,[1] obtained in cultures of the bacillus of pleuropneumonia, but differs from that of Leber,[2] which he extracted with alcohol from cultures of the Staphylococcus pyogenis aureus. If Leber's discovery is confirmed, it shows that the bacteria of suppuration can produce several pyogenic substances, and that it is by their intervention that suppuration is produced in the tissues. Christmas concludes, then, that suppuration must be considered as an effect of the reaction of the tissues against certain chemical substances which may be produced by living organisms or by those substances of a purely chemical nature. This paper would have been much more convincing if its author had not only given us the details of his experiments, but also if he could have satisfied us that the "suppurations considérables" which he saw so frequently were anything more or more definite than the "coagulation necrosis" which has been seen more than once before, and has also been more than once mistaken for true suppuration. Under any circumstances his experiments will have to be repeated and confirmed by independent observers before they can be accepted as positive proof of his statement; and, whether they be proved or disproved, the situation of things will remain the same, and bacterial activity will still be considered necessary for the production of any general systemic symptoms; and for this reason: it has always been carefully stated that the results forming the subject of discussion in this paper were to be considered as being due to the activity of the bacteria themselves or to the products resulting from this activity. It may be true that the symptoms are the result of the ptomaïnes or leucomaïnes produced as a result of bacterial growth, and not to the bacteria themselves; but it is equally true that in the majority of cases of septicæmia or pyæmia the symptoms are of gradual occurrence: they do not appear at once and in full force, as would be the case if the cause were a chemical one pure and simple, but there is a period of beginning, increase, and a decline when the termination is not fatal, all pointing toward a constant renewal and increase and decline of the cause producing those symptoms. A constant change in the amount of the morbific material present, in other words, and this constant change in the amount present, and with it the intensity of the symptoms, vary first and foremost with the increase or decrease of the number of bacteria present, or, if it is liked better, with the amount of the chemical products present; which must be in accord with the activity of growth of these microorganisms going on or completed at the time. So that even if it be true that suppuration is, after all, speaking scientifically, a chemical process, it does not alter the facts of the relation of bacteria to its production, for the reason that no careful observer has ever denied that there may be some intermediary between the growing bacteria and the changes produced in the medium in which they grow, or that this may very probably be found in some of the chemical compounds resulting from the retrograde metamorphosis of substances in which they flourish. Every one has realized that this retrograde metamorphosis must result in the formation of new compounds, and the nature and compositions of these new compounds are but just beginning to be studied: so new is the subject, indeed, that the very existence of what is undoubtedly an enormous and distinct class of substances, and these substances of the greatest importance in medicine, is but barely recognized by a vast majority of the physicians of to-day.

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[1] *Virchow's Archiv*, Bd. cx.

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[1] *Comptes Rendus*, 1888, Nos. 19 and 25.

[2] *Fort. d. Med.*, Bd. vi., June 15, 1888.

How is it proven that bacteria are connected with disease as causal factors? What is the evidence required upon such a subject in general, and in regard to the special affections under consideration? The following steps are always necessary: 1. The constant occurrence of microorganisms in the lesions of the disease under consideration. 2. Their isolation from these lesions and observation as pure-cultures under artificial conditions outside of the body. 3. The production of similar lesions to those in which they were first found upon inoculation into animals susceptible to the disease. These are the main points: of course there are many details which are added whilst the work is being carried on, and which tend to ensure the accuracy of the whole. Have these conditions been fulfilled in regard to septicæmias and pyæmias in general, and the localized clinical affection called puerperal fever in particular? The answer is emphatically "Yes"—that it is in these very processes that our knowledge of the specific pathogenic properties of bacteria is most extensive and most accurate. The first condition has been most thoroughly worked out, and always—in every case examined under proper conditions—there have been found micro-organisms in the individuals affected; and these micro-organisms, upon being subjected to pure-cultivation and inoculated into animals, have produced results similar to those seen in the original lesion in which they were found. Frequently more than one variety has been seen, and usually each one has been shown to have pathogenic properties of its own, although occasionally a non-pathogenic organism has been separated from processes produced by a more virulent organism growing with it. It has not been in the least possible to show that the clinical symptoms grouped under the head of pyæmia or septicæmia are always produced by the same organism. There are a large number which have been found in such affections, clinically similar, and which are yet known to possess distinct properties under cultivation and upon inoculation; so that it is no longer possible to speak of the micrococcus of pus as if there were but one, or of the septic vibrio, assuming the same condition of things.

There are a number of bacteria which will produce suppuration, as there are also a number which will produce septic intoxication; and the powers of each are not always confined to the one class of process, but may be exerted in the other, the difference at different times being due to the mode of entrance into the individual and the condition of the surroundings, as favoring or retarding their development after an entrance has been effected.

Septicæmias and pyæmias belong to that class of affections called "infectious wound-diseases:" they are the results of wounds to the integument or mucous membranes which permit of the entrance of bacteria. Wounds in this sense are not necessarily appreciable to the eye: the organisms with which we have to deal do not require a channel of entrance wide enough to be perceptible to our gross senses. Other conditions being equal, they need but a solution of continuity so small as to be with difficulty detected by the microscope, and therefore it is that "how they enter" is so often a mysterious problem; and it is because of the lack of appreciation of this fact that so many assertions are heard in regard to the impossibility of the bacteria found in a pathological process having anything to do with it as a cause, because they could not have got in from the outside.

The overwhelming testimony that they are not present in health, and that they do not create themselves, and that such pathological changes are produced by and do not go on without them, shows plainly enough, however, that they *do* enter the body at the beginning of the pathological change, although the mode of entrance is not always as clear to us as in the case of an open wound that does not do well and is followed by a general infection of the body.

"Modes of infection" have not been a subject of recent investigation: many of the present ideas in regard to miasmatic infectious disease are not new, and the science of epidemiology is much older than bacteriology, and has taught us many things; and the question arises whether from this study we have any more or better light upon the "miasm" of contagium or of "miasmatic contagium" than we had before, or whether we have any better idea of the transmission of disease from the sick to the well, or of that very active question, the one of "predisposition." And the answer is "Yes"—that the nature of infection and infectious diseases is better understood than ever, for most modern authors are agreed that it is equivalent to the entrance and activity of bacteria in the living tissue. In the absence of any other probable—it may be said of any other conceivable—hypothesis, to refuse to accept the doctrine of a *contagium vivum* as applicable to all infectious disease, because it has been demonstrated only for certain of these diseases, is about as reasonable as to reject the law *omnis cellula e cellula* because this law has not been proven for every cell or every species of cell.[1]

Originally, we find that the distinction between contagium and miasm was sharply defined, and a "contagium" was considered to multiply in the diseased body and to be capable of transmission to a healthy body; "miasm," on the other hand, was thought to be produced outside of the body, not to multiply in the body, and not to be emitted from the body in such a condition as to be capable of producing infection; that is, contagium was "endogenous" and miasm was "exogenous." These ideas furnished a fairly satisfactory working hypothesis for such diseases as syphilis and the exanthemata on the one hand, and for the typically miasmatic diseases, such as malaria, on the other; but they were completely upset upon the appearance of Asiatic cholera in the early part of the century, because here was a disease that manifestly—so it seemed—arose at one time from immediate contact with other cases, and at another from an apparently miasmatic source. Therefore a new term was necessary, and to satisfy the requirements of observed facts that of "miasmatic contagious" diseases was adopted; and in this class were placed cholera, typhoid fever, yellow fever, and several other infectious diseases that could not be classed under the special heads. In regard to these diseases, the most prevalent idea—invented to explain the differences in their apparent infectiousness at different times—is that they throw off a poison which is at one time capable of reproducing the disease, and at others not. Granting that this poison is of a bacterial nature, such a variation in virulence is contrary to all our knowledge of the life-history of these organisms, and is entirely unsupported by the facts observed. It is true that under forced conditions of experimentation a certain change in pathogenic power has been noted in some of these organisms, and, within certain limits, that this change can be produced at will; but no such variation has been observed either in organisms fresh from the body or in those which have been cultivated under normal conditions out of the body, even though this cultivation extends over a long time. On the contrary, observers in this line of research are inclined to ascribe especially active properties to the organisms freshly obtained from the pathological processes; and this opinion is supported by numbers of experiments, so that the apparent differences in the infectiousness of the various diseases of bacterial origin at different times are to be explained upon a different basis, if at all. And this explanation is readily found if only the modes of entrance and of elimination be considered. Thus in typhoid fever the method of elimination of the producing cause of the disease is by the intestines in the stools; and of course the chances of contamination by such means are very much smaller than in the case of such a disease as scarlet fever, in which the elimination occurs, at least in large part, from the skin, and the poison is carried so easily from person to person in the fine dust resulting from the drying and exfoliating epidermis. In the same way we must look for the explanation of the origin and transportation of such a disease as puerperal fever. Being unquestionably due to bacterial action, how are we to explain its course? The innumerable histories of numbers of cases arising in the practice of one man, the individuals being separated from each other and from other cases of the disease, and the history of the epidemics in lying-in hospitals, can be interpreted in but one way; and that is, that the poison is brought to the patient from some other case, is not eliminated unless taken away upon fingers, instruments, or utensils, and is most certainly not in any sense or degree of a miasmatic nature. And yet how little the true nature of puerperal fever is understood—even to-day by some of those who should know—is very well illustrated by an article in the *Edinburgh Medical Journal* for May, 1888, where will be found reported a case of puerperal septicæmia caused by the patient's proximity to a case of gastric cancer. At first the connection between these two is inexplicable, and it becomes even more so upon reading the additional history of the case, this simply showing a misapprehension of the facts, which are plain enough, one would think, without being twisted.

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[1] Welch: *Modes of Infection.*

The account goes on to say that the adherent membranes were removed by the hand *in utero*, and that "the next day" a 1 : 5000 sublimate douche was given. One would suppose that, knowing the difficulties of rendering the hands aseptic, and considering the late time of the use of the douche, it would be more natural to look for the cause on the hands, rather than to seek an explanation which avoids individual responsibility, to be sure, but is not in the least degree in accord with the facts brought together by modern science and so generally recognized to-day.

It may be said, "All this may be very true, but what is its bearing upon the special question at issue?" The answer is this: All that class of diseases called "infectious wound-diseases" are to-day known to be due to the activity of micro-organisms, this knowledge having been gained, in many cases, by rigid scientific experiments, and in others by analogies forced upon us by knowledge gained in this way. In this class of cases must be included those processes known as septicæmia and pyæmia; and—here is the special point—puerperal septicæmia, pyæmia, whatever name one may choose to give to it, is, in the first place, only a clinical separation from the general group of septicæmias or pyæmias arising from many sources, and is, in the second and most important place, essentially an "infectious wound-disease." No pathological changes have ever been noticed in cases dead of puerperal septicæmia that differ in any way from those acknowledged to be characteristic of septicæmias in general, except perhaps in situation; so that they are all alike in that respect. The clinical histories are the same, the symptoms varying in intensity in puerperal cases as they do in others, with some additional ones of course, as the process is more or less localized in the region of the uterus, so that the similarities are constant from this point of view. On the other hand, the parturient woman is most essentially in the condition of a *wounded* woman: there are invariably more or less important solutions of continuity in the genital tract, minute and imperceptible to the ordinary observation very likely, but none the less actual in their presence and danger, as offering a possible chance for the entrance of bacteria beneath the protecting shield of the mucous membrane. For a systematic description of the appearances in puerperal fever one must look into that of pyæmia and septicæmia in general; and that this idea is not new is shown by the assertion of Wilkes and Moxon, that "in proportion as fever following parturition is ascribed to simple inflammation about the uterus, in such proportion is it unnecessary to suppose the existence of any specific puerperal fever. But in a considerable division of such fevers the local inflammation is trifling or absent. The disease comes under the pathology of pyæmia; indeed, it appears that any general distinction between puerperal fever and pyæmia rests only in the relative frequency of contamination by fever poisons, which is much greater in the puerperal cases; for the rest, inspections of bodies dead of puerperal fever will offer examples of all the varieties of pyæmic accident."[1] In one form of puerperal fever, upon autopsy of those dead of metroperitonitis soon after parturition, the uterus is found usually flabby and dilated; its walls are soft and more or less macerated, while the venous sinuses are habitually filled to a greater or less extent with pus or a fibrino-puriform coagulum. The mucous membrane presents a wine-red color, and is soaked in a sanious puriform liquid, while the uterine body is pulpy and softened. At the placental site a vegetating surface is present, formed by the cotyledons of the mucous membrane. At the projecting, most prominent parts of the cotyledons are often seen small fibrinous casts. The entire placental disk is soft and infiltrated with a sanious and puriform fluid of a fetid odor, whilst often all this portion of the mucous membrane is gangrenous and of a brown-black color, from which flakes are detached upon immersion in water. At other times there is a grayish-white membrane, which becomes detached in fragments and under which the mucous tissue is reddish brown. This gangrenous or diphtheritic pseudo-membrane is sometimes extended over the entire surface of the uterine mucous membrane. Under the microscope a large number of lymphoid cells are detected in the fluid obtained by scrapings, and these cells show upon their surface or in their interior a greater or less number of pairs or chains of round bacteria. In the deeper layers of the mucous membrane and of the serous infiltrated chorion scrapings obtain a large number of lymphoid cells and large connective-tissue cells, which are swollen and fatty-degenerated. The neck of the uterus is softened, red or purple in color, and often covered with a gray pseudo-membrane, with an intensely congested tissue beneath. The same gangrenous lesions occur in places in the vagina or vulva. The venous sinuses may be empty or may contain a puriform fluid which may give place to coagulated fibrin or a softened semifluid mass, mixed with lymphoid or swollen and granular endothelial cells. The walls of the sinuses present the very characteristic appearances of an endo- and periphlebitis. The large veins are often filled with pus or fibrin, and the connective tissue of the large ligaments always contains a greater or less quantity of pus; and so much is this the case that purulent centres are usually found in the connective tissue, the lymphatics, or veins upon making successive sections of the large ligaments. The superficial lymphatic vessels of the uterus are usually filled with pus, and in all cases the peritoneum surrounding the uterus is the seat of an intense inflammation accompanied by redness, increased vascularity, the formation of fibrino-purulent false membrane upon its surface, and by a purulent infiltration of its connective tissue. Section of the ligaments through the infiltrated portions shows that when stained with methyl-violet *B.*, and then in iodine and iodide of potash (Gram's method), there are present large quantities of migratory and fixed swollen cells in the fibrinous bundles, and that the liquids and the cells present a mass of bacteria occurring in pairs (Diplococci) or in chains (Streptococci). The fibrinous false membranes, examined and stained by the same process, show between the bundles of fibrin vast numbers of lymphoid cells covered and filled with the same chain bacteria. These are the special appearances to be found in a recent and acute case of one form of so-called puerperal fever; but a consideration of this special affection requires, as has been insisted upon, a review of all that class of cases due to the absorption of septic matter through wounds, and giving rise to the general accompaniments of fever, subdelirium, prostration, poisoning of the whole organism, and a more or less rapid fatality. For accidents of this nature arising during the puerperium are surely the results of the introduction of poisons from without, and the parturient uterus is unquestionably a wounded surface—in the sense of a lesion of continuity always, and almost always in the more usual and accepted sense of an actual tear or wound of some of the parts. That the condition of the uterus must be considered, after parturition, as bringing the patient under the head of those liable to an infectious wound-disease is perfectly evident if the state of affairs be examined.

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[1] Wilkes and Moxon: *Path. Anat.*, p. 629, 1879.

In the production of such affections there are several conditions necessary, all of which are fulfilled in this case. There is required, first, a channel of entrance; second, a receptive condition; and, third, an active poison capable of producing results, the first two conditions being fulfilled. The channel of entrance is furnished, even in cases of normal delivery, by the temporary denudation of the placental site of its protecting membrane. This loss of the protecting power may be only temporary and of exceedingly short duration, but that it occurs in all normal parturient processes in the human race is distinctly proven by the best recent embryological researches. Actual wounds constantly occur also, even in what are called normal deliveries, by the stretching and consequent tears produced and that may occur throughout the vaginal tract—tears so small and insignificant that they produce no effect whatever of themselves, but quite large enough to present a means of entrance to such minute organisms as are bacteria. The second condition, that of receptivity, includes all of those causes that tend to lower the vital forces, even for a short time only. This lowering of the vital energy is a prerequisite to the beginning of any disease of whatever nature, and may arise from almost innumerable causes, of which physical exhaustion or mental is the most common. Now, in parturition both mental exhaustion and physical exhaustion are present always in some degree, the intensity of either varying greatly with the strength of the patient and the physical difficulty of the labor, or with the mental characteristics of the woman concerned. Here, then, are present—and unavoidably so—in every case the conditions most favorable to the entrance and activity, with their disastrous effects, of bacteria or their products; lesions permitting their entrance and the depression of vital energy allowing them to multiply afterward. The lesions are unavoidable, and the simple exhaustion following the muscular exertion of the expulsive acts equally so. Therefore it is that a parturient woman is in the same condition as a patient after a surgical operation. And the genital canal offers a more or less easy method of entrance to any poison, in any form, that will originate either a local or a general disturbance of the system; and therefore puerperal fever may be distinct, clinically speaking, but may, with equal certainty, be any form of septicæmia, pyæmia, or sapræmia (a name applied to those forms of infectious wound-disease produced by bacteria and with foul-smelling, putrefactive products), and may be due to any of the living ferments that are known to set up these processes. That it is not, in the vast majority of cases, due to an unorganized ferment, a chemical poison, is shown by the fact that, as a rule, the symptoms are general rather than local, and these symptoms can only be produced by something that is capable of reproducing itself.

In illustrating pyæmia or septicæmia from this point of view—that either of them is produced by the entrance of bacteria through the vagina or uterus—another description, amounting, perhaps, to about the same as that already given, would run as follows:

LESIONS OF PYÆMIA.—At the autopsy of individuals dead of pyæmia is found an œdematous putrefactive condition of the surface of wounds, with a gangrenous diphtheritic condition of the internal surfaces of the uterus and a phlebitis or a thrombosis of the regions originally affected. Bloody coagulations are found in the principal veins of the regions affected, which are often limited on the cardiac side by a branched and canulated anfractuous thrombus. Emboli are often found in the heart or pulmonary veins which are evidently detached from a venous clot: they are not infrequently seen in the pulmonary arteries, and sometimes there is also an endocarditis of the auriculo-ventricular valves and cardiac arterioles. There may be a nephritis, and finally multiple abscesses in various organs. These abscesses, which contain many masses of bacteria, are commonly found in the lungs, but are also exceedingly frequent in the liver, kidney, spleen, and muscles.

LESIONS OF SEPTICÆMIA.—Although there are degrees and variable gravities of pyæmia, they form a class of diseases more or less comparable to each other, and may be considered, clinically, to belong to one and the same group, because of the pretty constant presence of foci of suppuration. It must be remembered, however, that this distinction is merely one of clinical convenience, and has no bearing whatever upon the specific cause of the individual case or group of cases under consideration at the time. The real causes and the scientific determination of them can only be reached by bacteriological investigation. Setting aside, however, such cases as have just been described, there remain a larger number that are classed as "septicæmias," and which are variable not only according to the degrees of intoxication, but also seem to vary, from a clinical point of view, more distinctly in their causes and their progress, and are therefore considered under many differing categories. For example, Jeannel[1] describes in surgical septicæmia—1, simple traumatic or primitive fever of the wounded, which may be considered as the result of absorption of the blood or contused and mortified tissue; 2, subacute or *foudroyant* septicæmia, which is the result of the invasion of wounds by the large bacilli of gaseous gangrene—erysipèle bronze, progressive gangrene, gangrenous emphysema; 3, simple acute septicæmia or putrid infection; 4, chronic septicæmia.

In simple acute septicæmia the wound is gray or purple, and shows no tendency to healing, but gives out a sanious and often offensive discharge. Fever usually follows the traumatic fever, and it appears as if the patient were affected with a type of continued or typhoidal fever, which sometimes marks its onset with a chill. Upon autopsy there is noticed a rapid putrefaction, which seems to have begun with or even before death. There are no characteristic visceral lesions, the changes apparent consisting of a softening, together with a granular or fatty condition of the hepatic cells; an acute parenchymatous nephritis in which the kidney is soft and anæmic; a tumefaction of the spleen with softening; a congestion of the intestines; and sometimes an inflammation of the pleura or pericardium. Such a surgical septicæmia differs, then, in general from a pyæmia by its symptoms as well as by the absence of metastatic suppuration. But many varieties occur, and a class has been separated of pyo-septicæmias, where there appears suppuration with the general symptoms of septicæmia. All of which goes to show the facts that have been so many times repeated, that there is no definite dividing-line between these two classes of affections, that their symptoms are so variable that the names must be used as mere clinical conveniences, and that no single cause can be considered to produce either the one or the other. These causes are so manifestly varied in number and activity that no rational consideration of pyæmias or septicæmias in general can be made, or of puerperal fever in particular, without a knowledge of the different organisms which have been found to produce changes of this sort, and of the clinical products of their activity.

Before entering upon our review of the work done in this direction, the third proposition, necessary to a belief in the assertion that bacteria are concerned in the production of puerperal fever by their entrance from without, must be given some attention. This was—that micro-organisms must be proved not to be capable of self-reproduction anywhere—inside of the body more particularly, but outside as well. In other words, the old doctrine of *omnis ovum ab ovo* must be reaffirmed and made to apply to these single-celled plants as well as to the cells collected together and making up the tissue of the living animal organism. Such an assertion is hardly difficult to support to-day, and it seems unimportant to pay any attention to it by those best skilled in modern research. The older experiments, to prove the truth of spontaneous generation by showing that a tightly-corked flask of fermentable material would ferment and show active forms of life in certain cases, even after prolonged boiling, have been entirely discredited since the discovery of the existence and resisting powers of spores; and the experiments tending to show a variation of form and pathogenic powers in an organism have been equally shown to rest upon faulty methods. Of this latter class the most prominent were the results obtained by Naegele, who claimed to have seen the harmless "hay bacillus" (*B. subtillis*), change into and take on the properties of that most virulent of organisms, the *Bacillus anthracis*. In this case there was evidently a substitution of the one organism for the other during the progress of the cultivation experiments—a result easily obtainable by reason of the greater activity of the one over the other—and the mistake might readily be made of supposing the original organism to be still present after the substitution had occurred, because of the very great similarity of the microscopic appearances of the two. A repetition of this apparent change in pathogenic properties has never been reobtained, even in the case of these two organisms, and most certainly never in any other case. Assertions to the contrary, derived from supposed clinical facts, are numerous without doubt, but no such assertions can be accepted to-day in the face of the enormous numbers of crucial experiments showing the contrary. It must be accepted, therefore, that, so far as proof goes, no micro-organism that has been isolated and cultivated under artificial conditions ever undergoes such a complete change of power as this. Variations in power are shown, and can be produced at will by variations in temperature, moisture, air-supply, etc., but even these are but poorly understood, and almost always such results are obtained only under forced conditions that are not likely of occurrence outside of the laboratory.

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[1] *Encycl. Internat.*

The facts as shown, then, prove that bacteria do not arise by spontaneous generation anywhere; and this being true, as well as the fact that they have never been found in the body in health, their presence there in disease must be ascribed to an entrance from without, and the finding of suitable conditions for their development after this entrance has been effected.

We have now, therefore, reached the point at which we can confidently affirm that bacteria or their products are the exciting causes of such affections as the pyæmias and septicæmias, because we have shown that the line of experimentation suggested as a necessary preliminary to such an assertion has been carried out. That is, bacteria have never been found in healthy human tissues; they have been shown to be incapable of self-production; and the methods of their entrance into the body have been indicated.

In addition to this, the etiological importance of many of them has been most carefully studied and made out by the employment of the only means to that end—isolation, pure-cultivation, and successful inoculation-experiments. And here comes in a difficulty that has been encountered by all experimenters in the investigation of the special class of clinical disturbances grouped as puerperal fever. Many organisms have been found in cases of these disturbances and pure-cultivations of them have been made, but the result of inoculations of these pure cultures in the vaginæ and uteri of parturient animals has been purely and uniformly negative. These same organisms introduced into the same animals by other methods, cutaneous, subcutaneous, or circulatory, have invariably given characteristic disturbances, but not when introduced in the uterus or vagina, unless a special wound was made for their introduction. At first sight it would appear that if no results can be obtained in animals with organisms obtained from puerperal women by the same methods of introduction in animals as are claimed to occur in women, the assertion that the vagina and uterus are ordinarily the channel of entrance in women would receive a serious if not fatal blow. And such would certainly be the case if it were not for the marked difference in the condition of things after parturition in the females of man and the lower animals usually used for experiment. In the first place, the conditions of the females of the latter are in every way better for undergoing the processes of parturition. Living as they do under the laws made for them by nature, and being selected cases always by the free operation of the law of the survival of the fittest, parturition is, with them, as natural and almost as easy an act as defecation; and there is none of that tremendous physical and mental disturbance occurring in the women of civilized races and furnishing one of the favorable conditions for the entrance and activity of poisonous agents. So also there occurs none of the stretching and tearing of the tissues seen in civilized women, undoubtedly the results of faulty physical and moral laws. That these things are the result of such effects may be seen by glancing at the stories of parturition told in Englemann's *Labor Among Primitive People*, 3d ed., St. Louis, 1884. But the negative results obtained in experiments of this nature upon animals are further explained by the fact mentioned above —the differences in the anatomical conditions between the two. In the woman histological researches show that, at any rate, at the placental site there is a loss of the epithelium of the mucous membrane, and that this loss persists after the coming away of the placenta for a greater or less length of time which may be counted by days.

There is here, therefore, even in the most normal case of delivery, a place of entrance for bacteria and for the creation of local or systemic disturbances if any of pathogenic powers be present. On the other hand, whilst this loss of epithelium occurs in animals during parturition, it is almost, and in some cases completely, repaired before the coming away of the placenta, and at the most the repair is complete in a very short time after delivery, counting almost in minutes. Therefore there is not in such cases as there is in women any channel left open by nature for the entrance of bacteria, pathogenic or not; and the contrast between the two conditions is complete, civilized woman being after parturition in the condition most receptive for the entrance and development of bacteria; animals, on the contrary, being prepared by nature in the condition most effective under the circumstances for resisting the entrance of septic poisons by such channels as the genital tract. So that it is not surprising that inoculations in animals by simple uterine injections should be negative in their results, and the non-success of such experiments, explained in this way, cannot be taken even as negative evidence, the more especially as successful results are obtained if the point of the inoculating needle be introduced under the mucous membrane of the uterus or vagina.

Having reached this point in the discussion, it is extremely interesting to mention some of the organisms that have been found in patients affected with puerperal fevers, before entering upon the more systematic classification according to bacteriological methods that must be made before a true idea can be formed of what these processes mean. For, although it is true that a number of organisms have been found in the lesions of puerperal fever, nevertheless, considering the name as applied merely for convenience and not as denoting a specific disease, no complete view of the case can be had unless all the micro-organisms are considered that are known to produce septicæmic, pyæmic, or suppurative processes. Of the work done specifically upon puerperal fever only a brief view is necessary, and that only to show the truth of the assertion that more than one form of micro-organism is found in the processes included under this head, each of these organisms being known to possess the power of producing pathological changes when introduced into the animal body. The review of these observations will be brief also, because, from the point of view from which this paper is written, attention should be devoted to the whole subject of the causes of septicæmias and pyæmias, rather than to what has been done in one direction only, and that direction forming but a small part of the entire subject. Pasteur and Doléris[1] give four varieties of bacteria occurring in cases of puerperal fever observed by them after the older methods of bacteriological research. These they classify as follows, according to their morphological arrangements: 1. Cylindrical bacteria (rods), appearing as large filaments just before or ordinarily after death,—"bactèries séptiques de Pasteur"—most commonly found in rapid septicæmias. 2. Micrococci in chaplets (chains, Streptococci), occurring in mild, attenuated septicæmias. 3. Micrococci in pairs, especially found in cases accompanied by suppurations. 4. Micrococci occurring singly or in irregular masses. Chauveau, cited by Arloing,[2] considers that all varieties of puerperal septicæmia can be produced by an organism which is arranged singly, in pairs or in chains, but that the activity of this organism is not proven to be confined to puerperal fever alone—an illustration of the point that it is being attempted to show in this paper. E. Fraenkel found in two cases dead of puerperal fever small rod-shaped organisms in the spleen which corresponded very closely with Rosenbach's "Bacillus saprogenes III." and Passet's "Bacillus pyogenes fetidus" (*vide infra*). These organisms upon isolation and cultivation were found to be harmless upon subcutaneous inoculation in mice, guinea-pigs, and rabbits, and to the two latter upon intraperitoneal injection; but they produced death in rabbits in twenty-four hours after intravenous injection, and an abdominal effusion in mice after from three to six hours—seldom later—followed by death and the discovery of the same bacilli in the blood, lungs, heart, and pleura. Of the later investigations these are the most interesting. Brieger[3] investigated seven cases, and found in all the Staphylococcus pyogenes aureus and the Streptococcus pyogenes. In only one case did he find any form of bacillus. Subcutaneous inoculations in animals of the blood from these cases gave no results, and from this fact Brieger concludes that it is the *toxine*—a ptomaïne formed by these organisms—that causes the fatal result in puerperal fever; in other words, that it is the product of bacterial activity, and not the bacteria themselves, that produces the effects. Karlinski[4] experimented upon the milk of a lying-in woman who was affected with erysipelas. Using the method of plate cultures for isolation, he found the Staphylococcus pyogenes aureus, the Staphylococcus pyogenes albus, the Staphylococcus cereus albus, and the Staphylococcus cereus flavus. The child of this mother was attacked by a septicæmic process, consisting of catarrhal gastritis and enteritis, peritonitis and pleuritis, double parotitis, and lobular pneumonia, and the same bacteria were found in the blood and intestinal contents of the child as were present in the milk of the mother—a striking coincidence, surely, but, as the author says, not enough, being but one case, to actually determine the etiology of the disease in the child.

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[1] *La Fièvre puerpéral et les Organismes inférieurs*, Paris, 1880.

[2] *Recherches sur les Septicémies*, Lyon, 1884.

[3] *Charité Annalen*, Jahr. 1888, S. 198.

[4] *Wiener med. Woch.*, 1888, No. 28.

Netter, by Pasteur's method of inoculating the saliva under the skin and observing the resulting lesions, found in healthy persons the Streptococcus pyogenes in 5.50 per cent. (7 out of 127 cases), Friedländer's pneumonia bacillus in 3.93 per cent., and Fraenkel's pneumo-bacillus in 20 per cent. In two cases both these latter were seen.

These instances furnish evidence enough of the variety of organisms that may be found in the processes included under the head of puerperal fever. Many other observations have been made of a similar character and with a similar result—*i. e.* the demonstration of the fact that more than one variety of pathogenic organism may, and generally does, occur in situations like those under consideration. And other experiments have been made to show how they get into the body. The means of conveyance are unquestionably, in most cases, the hands and instruments of the attendants; and how this may occur in the case of the hands is well shown by the difficulty experienced in cleansing them. Furbringer[1] and others have studied this point very carefully from a bacteriological point of view, and when the difficulty of rendering the hands aseptic which they found in the way is considered, it is easy to see how little effect the ordinary washing would have upon any septic material upon them, and how unconsciously this might be carried about upon the fingers.

But more recent investigations seem to show the possibility of puerperal infection although there may be no pathogenic bacteria about the attendants, instruments, or atmosphere in contact with the woman during or after labor. This, of course, could not happen unless pathogenic bacteria had their habitat in the genital tract of healthy women; and this has usually been supposed not to be the case, the bacteria found there in health (in the vagina) having been thought to be innocuous. Winter[2] found that neither the Fallopian tubes nor the uterine cavity contains bacteria in health; that, on the other hand, the secretions from the cervix and vagina of healthy women contained many bacteria; and that in one-half the cases some pathogenic varieties were found. But he goes on to say that the virulence of these organisms was attenuated, because inoculation-experiments made with them were unsuccessful.

It does not seem to have occurred to this author nor to the commentators upon his work that this failure of his inoculation-experiments was to be ascribed to another cause, and that is the fact that the organisms he found were not pathogenic in the first place. For his mere observation of similarity cannot be allowed to prove identity, and the failure of the crucial test, the inoculation-experiments, must be ascribed to faulty diagnosis, and not allowed to upset one of the strongest points in bacteriology, that bacteria do not change their nature except under most unusual conditions, and that rarely. Therefore when similarities of growth to a known pathogenic organism are seen, and inoculation-experiments fail to produce the results usual when the true organism is used, the failure must be set down to mistaken identity or faulty *technique*, and not to a supposed "attenuation" of virulence. Winter's work, about which much has been said, is therefore unreliable to a degree, so far as furnishing any freedom from personal responsibility for the occurrence of puerperal fever is concerned.

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[1] *Untersuch. und Vorschriften und die Desinfektion der Hände des Aerztes*, Wiesbaden, 1888.

[2] *Zeit. f. Geburtshülfe*, Band xiv. S. 443.

Orth[1] reaches a different result from Winter upon the first point, for he examined a number of women during the puerperium, and, contrary to Winter's results, not only found no pathogenic organisms, but he found no bacteria at all in the uterus or upper portion of the vagina. He reaches the conclusion as the result of his experiments that the lochia of healthy women are entirely innocuous, and do not become otherwise except under the influence of introduced organisms. Fehling[2] also reaches conclusions in accordance with these facts. He considers that direct infection, since the introduction of careful methods of disinfection of the hands and instruments, is rare. He believes that pathogenic organisms come, not infrequently, from infected linen, furniture, and air, and he divides infection into two classes, primary and secondary. He thinks that primary infection is that resulting from the direct introduction and contact of pathogenic germs from without, whilst secondary infection is due to the absorption of ptomaïnes produced by the activity of bacteria which have entered the genital canal during, before, or after labor. Strauss and Sanchez-Toledo[3] investigated the subject of the occurrence of bacteria in the uterus or vagina after normal parturition. They claim that Doléris[4] considered it from the pathological, and not from the physiological, point of view; and they also mention Döderlein's results, finding that the lochia of healthy persons were harmless, but that the lochia of the sick were pathogenic and usually contained the Streptococcus pyogenes. These authors failed to find any bacteria in the uteri of the animals examined, and Goenner was equally unsuccessful in the case of women.

Strauss and Sanchez-Toledo found, further, that it was possible to introduce large numbers of anthrax bacilli, vibrions septiques, bacillus of charbon symptomatique, and Staphylococcus pyogenes aureus into the uteri of animals just after parturition without result, and explain the fact by the differences in anatomy between the case in animals and in women that have been already spoken of. Döderlein, in further illustration of what may occur, describes a case of instrumental abortion after hemorrhage which was followed by fever and death. Streptococci were found in the uterus, knee, middle finger, and in the pus at the base of the ankle. Death occurred from purulent meningitis, with no peritonitis. The patient had had erysipelas a year previously, and the cervical lymphatics were softened and the probable source of infection. In connection with this case Döderlein stated his belief that puerperal septicæmia arises from the infection of the uterine cavity or by specific infection of the lesions occurring during labor—that the organisms producing the symptoms can be introduced from the abdominal cavities, intestinal disease, or by masturbation, so as to infect the cavity of the uterus; and he remarks that it is evident that we cannot discuss auto-infection clearly until we are certain of the thorough disinfection of the uterus and vagina of the cases under consideration.

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[1] *Arch. f. Gynäkol.*, Bd. xxxii. Hft. 3, 1888.

[2] *Ibid.*

[3] "Recherches microbiologiques, etc.," *Annales de l'Institut Pasteur*, August, 1888.

[4] "Essai sur la Path. et la Therapeut. des Accidents infectieux des Suites des Couches," *Thèse de Paris*, 1880.

The influence of an agent not often thought of in connection with septic absorption in puerperal fever has been discussed by Hicks,[1] who suggests that the manipulations of the uterus, and the motions consequent upon these manipulations, may sometimes induce absorption that would not otherwise occur; which is very probably the case. Thus, the sudden withdrawal of the hand after firm compression of the abdominal walls might favor an indrawing of material from the vaginal to the uterine cavity; and another favoring element may be found in the sudden turning on the side from the back. In such a case the absorption would be favored from the inner surface of the uterus, because its walls are often flabby, and upon turning over the abdomen and uterus fall decidedly if unsupported, and there is at once a tendency to a vacuum which determines a flow toward the abdominal cavity. Such influences as these are undoubtedly aiding factors in the accomplishment of the absorption of septic poisons in all cases, and are of unquestionable importance in studying the means of the production of the results seen from such absorption; and they should be guarded against, perhaps not as carefully as the presence of the poison itself, but nevertheless as being elements in the important system of prophylaxis that we are endeavoring to perfect.

We have given illustrations of what has been done in the investigation of the bacteria occurring in puerperal fever, and we have seen that they are of many differing kinds, even under the microscope, and that these differences are shown to be even more frequent when the organisms found are subjected to cultivation and isolation. There is not, therefore, any simple organism, any specific living ferment, which is the cause of puerperal fever. We have shown, too, how many sources of entrance to the body there may be for the organisms that will produce pyæmic or septicæmic processes; that this channel of entrance usually occurs, and may always occur, in the vaginal canal or uterine cavity, but that it may also be in other parts of the body,[1] where the micro-organisms, entering the body at one place, are transferred to the place of least resistance by the blood current, lymph-channels, or leucocytes, and manifest their presence there by the pathological processes that follow their activity. It will be seen, therefore, that for a proper consideration of puerperal septicæmia alone a consideration must be made of septicæmias and pyæmias in general, and that anything that may produce any of these processes may equally be concerned in the production of that especial form of these processes called puerperal fever. It is necessary, therefore, to speak of each organism that has been isolated from a septicæmic, pyæmic, or sapræmic process, or, in fact, from any other source, and which has been cultivated and found upon inoculation to produce suppuration or septicæmic changes in inoculation-experiments upon the lower animals. This will include, of course, a description of organisms that have never been found in the course of puerperal fever, but such an inclusion is justifiable and necessary because of what has already been said. Because any micro-organism that is known to possess the power of producing such pathological changes as are under consideration may at any time be the cause of a special case of puerperal fever, and because it has not been observed to be so, it is unwarrantable to assume that it cannot.

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[1] *Am. Journ. Med. Sciences*, July, 1888.

The micro-organisms connected with suppurative, pyæmic, septicæmic processes having been considered, the view of the whole will not be complete without as perfect a reference as is to-day possible to the action of those products of theirs—the animal alkaloids—in the causation of the processes in which the bacteria occur, and of whose activity they are the result. In speaking of the various bacteria that will be mentioned, the order of frequency of their occurrence will be followed, and more especially of their occurrence in puerperal affections of the nature of those being studied. The description is based upon that required by the best modern scientists for the identification of a bacterium, and will include, so far as possible, a mention of the discoverer, its origin, shape and usual arrangement, motility, behavior under cultivation in various media, the best temperature for its development, rapidity of growth, spore-formation, gas-production, power or not of liquefying nutrient gelatin, behavior toward aniline dyes, and pathogenic properties. By such a course, then, the first organism to be spoken of would be the—

1. *Streptococcus pyogenes* of Rosenbach and Passet. Found in

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[1] *Vide* Döderlein, *supra*, and Rosenbach, *Der Eit. Phleg. des Menschen.*

progressive erysipelas-like suppurations, and consisting of cocci arranged in chains of sometimes as many as thirty, but often of no more than two. Has no especially characteristic method of growth, except that it is sluggish in any culture-medium, develops best at the temperature of 35–37° C. (blood temp.), but fairly well at summer temperature. Its growth is slow, being only 2–3 mm. broad in needle-cultures after two or three weeks. After four months the culture is nearly if not quite dead. Not especially affected by the absence of oxygen, and changes albumen in a vacuum. Does not liquefy gelatin, and can be stained by Gram's method (*i. e.* decolorizing with iodine and iodide of potash sol.). Upon inoculation produces erysipelas-like suppuration.

2. *Streptococcus erysipelatis.* Fehleisen.[1] Found in the cutaneous lymph-channels in erysipelas. Very small cocci, occurring in pairs or long chains, more especially upon culture in bouillon. Grows only in the needle-track in gelatin, not on the surface; very little upon agar-agar, not at all upon potato, and very profusely in blood-serum at 37° C. Its best development is at 37° C., but slow at that. Does not liquefy gelatin, and is stained by Gram's method. Produces in rabbits a sharply-defined spreading redness without suppuration, and a characteristic erysipelatous process in man. Most probably identical with No. 1.

3. *Bacillus œdematis maligni,* "vibrion septique." Hesse,[2] Gaffky,[3] Koch,[4] Pasteur,[5] Liborius.[6] Found in garden earth; consists of rods of from 3.0–3.5 micro-millimeters long, and $1-1\frac{1}{10}$ micro-millimeters broad, usually occurring two together, but sometimes consisting of chains from 14 to 40 micro-millimeters in length. It is smaller than the anthrax bacillus, with rounded ends. It is very motile, and has no special characteristics as colonies. It grows best at the temperature of the body, and very rapidly. Produces spores at its ends at the close of the first day, and most rapidly at 37° C., more slowly at summer temperature. Is entirely anërobic, growing only in the absence of oxygen. Produces no gas; liquefies gelatin; stains with all aniline colors, but not with "Gram." Kills guinea-pigs in from twelve to twenty-four hours with appearances of widespreading subcutaneous œdema and gas-production.

4. *Staphylococcus pyogenes aureus.* Rosenbach,[7] Passet.[8] Very frequently found in pus, consisting of cocci of varying size arranged in masses or pairs, and of a medium size of 0.87 micro-millimeters.

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[1] *Die Aetiologie des erysipels,* Berlin, 1888.

[2] *Deut. med. Woch.,* 1885, No. 14.

[3] *Mitt. a. d. Kais. Ges.-amt.,* Bd. i. S. 1.

[4] *Ibid.,* S. 54.

[5] *Bull. de l'Acad. de Méd.,* 1887, p. 793.

[6] *Zeit. f. Hyg.,* Bd. i. S. 158.

[7] *Mikro-organismen bei den Wundinfektionskrankheiten des Menschen.*

[8] *Aetiologie der Eiterigen Phlegmonen des Menschen.*

Its specially characteristic appearance under cultivation is the orange-yellow color of its colonies, its liquefaction of nutrient gelatin, and the foul smell of the colony upon potato. It grows best at from 30° to 37° C., and somewhat more slowly at summer temperature. Its growth in general is rather rapid. Spores have never been found, but the organism shows a remarkable resistance to destructive agents. It lives a long time without oxygen, changes albumen, and liquefies gelatin. Stains well by Gram's method. Produces many varieties of suppuration by any of the methods of inoculation.

5. *Micrococcus of Osteomyelitis.* Becker.[1] Found in the osteomyelitis of sheep. Probably identical with the preceding, because answering in every way to the description of the former under the microscope, cultivation, and inoculation.

6. *Staphylococcus pyogenes albus.* In every way identical with No. 4, except that it produces no pigment, its colonies being white. A colony retained its vitality for three years and a half without oxygen.

7. *Micrococcus pyogenes tenuis.* Rosenbach. Rare, but when it is found it occurs in widespreading malignant phlegmons, and as cocci somewhat larger than the staphylococci, but without any regular arrangement. It grows in nutrient agar-agar very slowly as a thin almost transparent layer, and does not liquefy gelatin. Some of the large individuals have a deeper staining at their poles. Its pathogenesis has not been shown.

8. *Staphylococcus pyogenes citreus.* Passet. Found in pus, and morphologically, as well as physiologically, identical with No. 4, except that it produces a lemon-yellow color in its colonies.

9. *Staphylococcus cereus albus.* Passet. Found in pus, and consists of cocci of irregular size occurring in masses, and occasionally in chains, growing on gelatin as white or grayish-white layers with thickened, waxy-looking edges. Is non-liquefying, and has not had its pathogenesis investigated.

10. *Staphylococcus cereus flavus.* Is exactly like the preceding, except that it is found very infrequently, and produces a lemon-colored pigment in its colonies, which is darker than occurs in No. 8.

11. *Bacillus saprogenes I.* Rosenbach. Found in the white plugs of the follicles of the tonsils. Is a large bacillus, with large spores often to be seen. Produces yellowish-gray colonies on agar-agar, with a smell like burnt cooking and an extremely foul smell upon blood-serum. Grows slowly, produces very large endogenous spores, is aërobic. With oxygen produces an intensely foul odor; without it, a very gradual and slow putrefaction of albumen. No pathogenesis yet shown.

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[1] *Deut. med. Woch.*, 1883, No. 46.

12. *Bacillus saprogenes II.* Rosenbach. Found in the secretions of foul feet. Is a bacillus somewhat smaller than the preceding, growing upon agar-agar as numerous fine drops, coalescing, and then forming a uniform translucent and then opaque layer with the odor of foul-smelling feet. Has a very rapid surface growth, is aërobic and facultatively anaërobic, with an unbearably foul smell when the access of oxygen is unrestricted; less so if the supply of oxygen be diminished. It has invasive and pyogenic properties.

13. *Bacillus saprogenes III.* Rosenbach. Found in septic gangrenous pus. Grows without special characteristics upon agar-agar, with medium rapidity. With oxygen produces rapid change in albumen, slower without, and a very foul odor when cultivated in milk. Upon injection, either subcutaneous or in the joints of rabbits, it produces a yellowish-green infiltration, with wide destruction of tissue and a foul smell.

14. *Bacillus pyogenes fœtidus.* Passet.[1] Found in an abscess of the anus. Short staffs with rounded ends. $1\frac{45}{100}$ millimeters long by $\frac{45}{100}$ broad, often occurring in pairs or more together in chains. It possesses slight motion, and presents nothing characteristic upon culture, but a clear brown colony upon potato of extremely rapid growth, non-liquefying, and upon injection into mice and guinea-pigs produces death in twenty-four hours, with masses of bacilli in the blood, but none at the point of inoculation or in the organs.

15. *Staphylococcus salivarius pyogenes.* Biondi. Found in the abscess-contents of a rabbit inoculated subcutaneously with saliva from a case of scarlet fever. Cocci smaller than most known, 0.3μ to 0.4μ in diameter, occurring in irregular masses. Has no especial characteristics under cultivation except the golden-yellow color of the colonies in agar-agar at blood-temperature. Shows great resistance to low temperatures, cold, and drying. Grows very slowly in gelatin, rapidly upon agar-agar. Liquefies gelatin slowly. Stains best by Gram's method, and produces localized suppuration upon inoculation into mice, guinea-pigs, dogs, and rabbits.

16. *Coccus salivarius septicus.* Biondi.[2] Found in the saliva of a person very ill with puerperal septicæmia. Round cocci, sometimes almost oval in form, with a depression in the centre visible upon very careful focussing. Shows no especial characteristics on cultivation, except occasionally an almost black color in colonies upon gelatin plates. Grows best at blood-temperature, but also at 18° to 20° C., and with medium rapidity, and does not liquefy gelatin. It stains easily with all aniline colors, and also by Gram's method. It is pathogenic for mice, guinea-pigs, and rabbits, killing them in from four to

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[1] *Loc. cit.*

[2] *Zeit. für Hyg.*, Bd. ii. S. 217.

six days. The bacilli are found in the blood and in the organs, but there is absolutely no sign of any suppurative process.

17. *Bacillus salivarius septicus.* Biondi.[1] Found in the sputum of healthy and unhealthy persons. Short elliptical rods, with slightly pointed ends and relatively thicker bodies, occurring as pairs in the blood and in fluids, but in the tissues as pairs with a capsule sometimes, and sometimes in chains and masses. Grows best in plates with the addition of a small amount of phosphoric, hydrochloric, or nitric acid, but without any other special characteristics, except that it does not cloud beef-bouillon. Best development at 35°–37° C., and its greatest virulence is shown when grown at 20°–22° C. There is no development at 10° C., and at 8°–9° C. it loses its virulence and transmissibility to other nutrient media as well. It grows extremely slowly, and produces no spores, being very susceptible to drying. It grows under mica, and in an atmosphere of hydrogen also. It does not liquefy gelatin. Stains with all aniline colors and with Gram, and is pathogenic for mice and rabbits, which it kills in from twenty-four to forty-two hours to fifteen to thirty days with all the clinical symptoms and anatomical changes of an acute or subacute form of septicæmia. It shows the most intense changes at the seat of inoculation, and is non-pathogenic for guinea-pigs, differing in this respect from No. 22.

18. *Bacillus of Chicken Cholera*—"Choléra des poules" of Pasteur. Found in fowls diseased with chicken cholera. Short rounded ends, staffs, growing often in threads, and staining characteristically. It possesses no motion; shows no marked peculiarities under cultivation; grows at both ordinary and blood temperatures, but very slowly. Does not develop under mica, and is non-liquefying in nutrient gelatin. The poles of the organism stain more deeply than the centre, so that it often looks like a diplococcus. It takes the usual nuclei-staining colors in sections, but cannot be demonstrated by Gram's method. The smallest portion of a culture produces characteristic symptoms in birds, followed by death. Pigeons, sparrows, pheasants, mice, and rabbits are susceptible, whilst in guinea-pigs, sheep, and horses it produces abscesses localized at the point of inoculation.

19. *Bacillus of Rabbit Septicæmia.* Koch.[2] Found in putrid infusion of meat, and resembling the preceding in every respect; probably identical with it.

20. *Bacillus of Pseudo-œdema.* Liborius.[3] Found in the œdematous fluid and tissues of a mouse inoculated with garden earth. A thicker bacillus than No. 3, with a thin capsule. Grows at ordinary temperatures, without special characteristics except the formation of a gas-bubble on the top of the colonies in gelatin, and slowly. It forms

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[1] *Zeit. für Hyg.*, Bd. ii. S. 196.

[2] *Wundinfektionskrankheiten.*

[3] *Zeit. f. Hyg.*, Bd. i. S. 163.

two spores in each rod, is anaërobic, produces an odor resembling old cheese or rancid butter, and does not liquefy gelatin. It kills rabbits and mice very rapidly, but very few bacilli are found in the dead animals, so that the result is probably due to the formation of a ptomaïne.

21. *Bacillus of Mouse-septicæmia.* Koch,[1] Gaffky and Loeffler.[2] Found in putrid-meat infusions and foul fluids. Is a very small rod, —0.8 to 1.0μ long and 0.1 to 0.2μ broad, usually occurring in pairs, and presenting at first sight an exceedingly close resemblance to fine needle-shaped crystals. Has no motion. Presents a characteristic appearance in gelatin needle-cultures, branching out from the needle-track in very fine white sprays looking like lines of vapor. Shows a very slight liquefying power in strongly alkaline nutrient-gelatin, and does not grow at all on blood-serum. It develops very slowly, produces spores, grows under mica, and is non-liquefying. Takes the usual nuclei-staining aniline colors, and may be differentiated by Gram's method. It kills house-mice in forty to sixty hours after cutaneous inoculation, but has no effect upon field-mice.

22. *Mouse-septicæmia-like Bacillus.* Bienstock.[3] Found in feces. An unusually small bacillus, somewhat larger than Loeffler's bacillus of "schweine-rothlauf." Length to breadth as 0.8μ is to 0.4μ, and easily confounded with micrococci. Possesses no motion. Grows very slowly without special characteristics upon agar-agar. Produces œdematous and erysipelatous disturbances in mice and rabbits.

23. *Diplococcus pneumoniæ.* A. Fraenkel, Weichselbaum,[4] Fraenkel.[5] Found in the sputum of lung diseases, especially in the rusty-brown sputum of pneumonia, in bad cases of empyæma, and in the exudation of a case of cerebro-spinal meningitis. Oval diplococci, whose members are lancet-shaped; under a high power they appear as rods whose ends are joined together by a fine filament, and often occur in chains of five or six elements. A capsule is often seen surrounding them in preparations from the body, but never in cultures. Possesses no motion, and is distinguished from all other cultures by the extreme delicacy of its growth. Does not develop below 24° C., best at 35°, and loses its virulence by variations in temperature. Grows very slowly at the best, is non-liquefying in gelatin, takes all aniline colors, and may be stained after Gram's method. Is pathogenic for mice, guinea-pigs, and rabbits, killing them all in twenty-four to forty-eight hours; and there are masses of the organism with capsules to be found in the blood and all the organs.

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[1] *Zeit. f. Hyg.*, Bd. i. S. 163.

[2] *Mitt. a. d. Kais. Gesund. amt.*, Bd. v. S. 80 und 135.

[3] *Zeit. f. klin. Med.*, Bd. viii. Heft 1.

[4] *Mikrobe der Sputumseptikaemie.*

[5] *Zeit. f. klin. Med.*, Bd. x. S. 401; *ibid.*, Bd. xi. Heft 5 und 6; and *Deut. med. Woch.*, 1884, No. 25.

24. *Bacillus resembling the Pneumonia bacillus.*—Passet.[1] Found in pus, and consisting of cocci, occasionally short rods. Grows on the top of gelatin in needle-cultures, rarely in the needle-track, and after three or four weeks produces a brown staining of the gelatin and foul odor. Grows very rapidly. Is aërobic, produces no gas, and is non-liquefying. Injected into serous cavities, it produces a suppurative disturbance, but with slight changes after subcutaneous inoculation, and none at all after inhalation.

25. *Diplococcus intracellularis meningitidis.* Weichselbaum.[2] Found in the fresh exudation of cerebro-spinal meningitis in six cases. Cocci sometimes single, usually in pairs or fours, or forming small masses. Their situation in the cells is characteristic. Grow without especially marked characteristics, only at blood-temperature, and with medium rapidity. Stains best in sections with Loeffler's alkaline methylene-blue and by Gram's method. Is pathogenic for mice, guinea-pigs, rabbits, and dogs, especially for the first.

26. *Bacillus septicus agrigenus.* Nicolaier, Flügge.[3] Found in the earth of manured fields. Bacilli like Nos. 18 and 19, but somewhat larger. Grows without special characteristics, and is non-liquefying. Behaves toward aniline colors like No. 19, but does not stain so sharply. It is pathogenic to mice, field-mice, and rabbits, but a relatively small number of the organisms are found in the blood or organs.

27. *The Streptococcus pyogenis malignus.* Flügge.[4] Found in the necrotic tissue of a leukæmic spleen, and cannot be distinguished under the microscope from Nos. 1 and 3. It produces the same sort of colonies upon cultivation as Nos. 1 and 3; grows more slowly than they do, and is non-liquefying in gelatin. Is pathogenic to mice and rabbits, with post-mortem appearances similar to those produced by Nos. 1 and 3.

28. *Streptococcus septicus.* Nicolaier and Guarneri.[5] Found in foul earth and similar to other streptococci, except that it has not such a tendency to form chains under all circumstances, and occurs in tissues mostly as pairs. Grows on gelatin as small fine colonies, similar to other streptococci. Grows still more slowly than the preceding, and is non-liquefying. Is pathogenic to mice and rabbits.

29. *Streptococcus septo-pyæmicus.* Biondi.[6] Found in the saliva of one individual with a phlegmonous angina, and of two others with primary erysipelas of the larynx. Round cocci 0.7 to 0.8μ in diameter, occurring in chains, of which the pairs are often made up of two of irregular size. Grows without special characteristics, except a yellowish-gray color, in colonies on agar-agar, at blood temperature after forty-eight hours. Is non-liquefying, and does not possess pathogenic

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[1] *Loc. cit.*

[2] *Fort. der Med.*, 1887, No. 18.

[3] *Mikroorganismen*, Leipsic, 1886, S. 257.

[4] *Ibid.*, 1886, S. 153.

[5] Flügge's *Mikroorganismen.*

[6] *Zeit. f. Hyg.*, Bd. ii. S. 225.

properties for mice, guinea-pigs, and rabbits, although it produces a typical erysipelas in the latter when injected into the ear. Very likely identical with No. 3.

30. *Streptococcus articulorum.* Loeffler[1] and Flügge.[2] Found in various forms of diphtheria in and out of the affected mucous membranes. Occurs in chains of sometimes more than a hundred, among which some are much larger than others; and in these large ones a transverse division may almost always be seen to be going on. Grows without any special characteristics, very slowly, and is non-liquefying in gelatin. Is pathogenic for mice; guinea-pigs are not susceptible. Intravenous injection in rabbits produces a typical joint affection, with death usually following.

31. *Bacillus necrophorus.* Loeffler.[3] Obtained in the processes resulting from inoculation of particles of condylomata in the anterior chamber of the eye of a rabbit. Bacilli of varying lengths, but of equal thickness, often joined in long undulating threads. Does not grow upon gelatin or agar-agar, and very slightly on horse blood-serum, and best in neutralized rabbit-broth. It is pathogenic to rabbits, producing a necrotic, cheesy sort of process.

32. *Brieger's Bacillus.*[4] Found in feces and artificially prepared putrefactive mixtures. Small rods, a little longer than broad. Very characteristic growth on gelatin-plates, like the markings on tortoise-shell, and on potato as a dirty-yellow layer. Pathogenic to guinea-pigs by subcutaneous injection, but produces no result if introduced by the mouth or anus.

33. *Emmerich's Bacillus.*[5] Weisser.[6] Found by Emmerich in needle-cultures from blood, tissue-scrapings, and discharges from cholera patients at Naples; by Weisser in normal as well as abnormal human feces, in the air, and in foul fluids. Short rods, singly or in twos, rarely more. One and one-half times as long as broad—about the size of the typhoid bacillus. Has no motion, and presents no diagnostic characteristics upon cultivation. Resisted twelve days' freezing at 24° C., and four weeks' drying at summer temperature. Spores not observed, but their presence very probable, because of this resistance. Is non-liquefying in gelatin, and does not stain by Gram's method. Its pathogenic powers especially investigated in regard to the production of choleraic symptoms.

34. *Bacterium coli commune.* Escherich.[7] Present constantly in the intestinal canal of men and animals examined and in the stools of

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[1] *Mitt. a. d. Kais. Ges. amt.*, Bd. ii. S. 451.

[2] *Mikroorganismen*, S. 153.

[3] *Loc. cit.*, S. 493.

[4] *Berl. klin. Woch.* 1884, No. 14.

[5] *Deut. med. Woch.*, 1884, No. 50; *Berlin. klin. Woch.*, 1885, No. 15.

[6] *Zeit. f. Hyg.*, Bd. i. S. 315.

[7] "Die Darmbact. des Sauglings und ihre Beziehungen z. Physiol. der Verd., 1886," *Fort. d. Med.*, 1885, No. 17.

infants. Its typical shape is a long rod, eight to twelve times as long as broad, with irregular sides, so that it may look like a chain of oval or round organisms; two rods usually occur together. It is possessed of sluggish motion; produces a pea-yellow color upon potato, but without other especially characteristic appearances on other nutrient media, and grows best at body-temperature. Grows with medium rapidity, and spores have never been observed, although clear, unstained spaces are often seen in the rods themselves. Is aërobic, produces a gas under anaërobic conditions, and does not liquefy gelatin. Produces diarrhœa and collapse after subcutaneous or intravenous inoculation in rabbits and guinea-pigs; is not pathogenic in mice.

35. *Bacillus of Intestinal Diphtheria in Rabbits.* Ribbert.[1] Found in the organs of rabbits which have died of a spontaneous diphtheritic process of the intestines. Rods of 3–4 micro-millimeters in length, and 1–1$\frac{4}{10}$ micro-millimeters in thickness, with rounded ends and often occurring in chains of two and more. No marked characteristics under cultivation; grows best at the temperature of the body, and with fair rapidity. Its growth is least when no oxygen from the air comes in contact with the culture. It is non-liquefying, and stains well with aniline-water fuchsin, and not at all by Gram's method. Produces death in rabbits in three days after injection into the ear vein, with masses of bacilli in the liver and spleen, and after subcutaneous inoculation a swelling of the neighboring lymph-glands. Injection into the abdominal cavity shows suppuration and inflammation of the entire intestinal tract inside and out, with a necrotic change very like the diphtheritic processes in man.

36. *Micrococcus botryogenus.* Johne; Rabe.[2] Found in tumefied swellings in horses. Micrococci of 1–1$\frac{5}{10}$ millimeters in diameter, occurring in pairs or chains. With not very characteristic growth upon culture-media, but a characteristic odor. Slightly liquefies gelatin. Kills guinea-pigs with symptoms of septicæmia, and produces a widespread œdema in sheep and goats.

37. *Micrococcus of Progressive Lymphomata in Animals.* Found in the expectoration of pneumonia following measles. Oblong cocci, with rounded, stumpy ends, usually occurring singly or in pairs, and from 0.4–0.6 millimeter in diameter. Produces a grayish-yellow pigment in gelatin and a yellow color on potato. The best temperature for its growth is from 18–37° C., it is much delayed at from 46–48° C., and it is destroyed at from 48–60° C. It grows rapidly on the surface of gelatin, and best with the free entrance of air, and is non-liquefying. Has no characteristic stain, and can be easily colored by Gram's method. The inoculated animals—dogs, rabbits, guinea-pigs, and

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[1] *Deut. med. Woch.* 1887, S. 141.

[2] *Zeit. f. Thiermed. u. Path.*, Bd. xii. S. 137.

house-mice—die in from seven to fourteen days, with an enormous swelling of the internal organs, and a collection of gray or grayish-yellow nodules which assume the type of granulomata.

38. *Bacillus of Rhinoscleroma.* Von Frisch,[1] Paltauf, and Von Eiselsberg.[2] Found in the scrapings of a tumor in rhinoscleroma. Short, rounded-ends bacilli, two or three times as long as broad, or oval cocci which may grow into longer bacilli or threads. Has no motion, and grows like Friedländer's pneumonia-bacillus. Best development at 36–38° C., and with medium rapidity. Often produces gas on potato, and does not liquefy gelatin. Stains well with Loeffler's methylene-blue solution. Stained with aniline-water gentian-violet, and then treated with dilute acetic acid or Ziehl's carbolic-acid fuchsin solution, the bacilli appear surrounded by a capsule. Upon inoculation into animals the bacilli produce suppuration of the pleura, abscesses in the subcutaneous and muscular tissue, with death of the inoculated animals.

39. *Tetanus Bacillus.* Nicolaier.[3] Found in earth. Fine bacilli, somewhat longer than, and not so thick as, Koch's bacillus of mouse-septicæmia. Grows on blood-serum at blood-temperature. Presents a characteristic spore formation, and stains best with fuchsin. Produces tetanic symptoms in the animals inoculated, with suppuration at the point of inoculation, and bacilli in the channels of the ischiatic nerves and spinal cord.

40. *Bacillus of Acne Contagiosa in Horses.* Dieckerhoff and Grawitz.[4] Found in the pus and dried scales of pustules obtained by inoculating a horse with "Englischen Pocken." Short straight or slightly curved bacilli, 0.2 millimeter in size. Grows without marked characteristics, but has a perceptible odor. Its best development is at 37° C., and it does not grow at all under 17° C. It grows rapidly on blood-serum, but very much more slowly on other nutrient media. Stains quickest and best in watery solutions of fuchsin, but a very beautiful color may be obtained by using Gram's method. Produces a typical acne upon rubbing into the skin of horses, calves, sheep, and dogs, and suppuration in rabbits. Upon subcutaneous injection there occurs an erysipelatous swelling, with a general intoxication of the animal, with mortification and suppuration.

This completes the list of organisms that have been found in the suppurative or pyæmic or allied processes in man or the lower animals, and that have been isolated, cultivated, and described, so that there may be comparisons made by new workers in the same field.

But the enumeration includes others than these. There have been put down, as necessary to a complete review of our present knowledge, not only those organisms that have been found in processes actually going on, but also those found in other situations, and shown to be capable of setting up local or general disturbances of the nature of those we are considering upon introduction in pure cultures into animals.

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[1] *Wien. med. Woch.*, 1882, No. 32.

[2] *Fort. d. Med.*, 1886, No. 32.

[3] *Deut. med. Woch.*, 1884, No. 52.

[4] *Virch. Arch.*, Bd. cii. S. 148.

These, of course, have not the direct value of the organisms found in pathological processes in man and shown to be capable of setting up similar changes in animals. But they cannot possibly be neglected, even if this link in the chain of evidence be wanting, for if they can so easily set up extensive changes in the lower animals—changes precisely similar to others occurring in animals and man—and if their habitat may be so widespread as is indicated by their occurrence in the earth or air, it must be assumed that these organisms also may be among the causes of changes more or less extensive in man, although they have not yet been found in those changes.

They should be looked for, however; and that an organism known to be capable of producing septicæmic or suppurative changes in animals may not be capable of doing the same thing in man can never be positively asserted, and may be put forward with only comparative security, and then only after an enormous number of examinations have been made—including cultivations—of these processes as occurring in man.

It is for this reason that so many of the organisms already described have been spoken of here in a place that at first thought seems inappropriate for such mention. But it is well for obstetricians to know what has been done upon the general subject, and how this work should be applied to the special one of septicæmias and other similar general disturbances appearing during the puerperium, for it is only by such knowledge that a sense of the general meaning of the individual cases can be obtained. The description of the organisms has been made as brief as was in the least consistent with a mention of them at all, so that it may seem as if, reading only what is said about them here, it would be exceedingly difficult to separate some of them. But this is not so in reality if the fuller descriptions published in the original articles treating of them be consulted. For example, it is often said in the descriptions that there is no marked characteristic appearance "upon cultivation;" but this only means that there is no one thing shown by the colonies upon any form of nutrient medium which enables it to be identified at once, as in the case of the typhoid bacillus grown upon potato. The minute description of the colonies oftentimes shows a group of characteristics not diagnostic by themselves, but which, taken together, make possible the classification of the organism and its differentiation from others; but this minute description was necessarily omitted as being unnecessary and because of lack of space. The review of this list of organisms shows us, however, another and extremely important probability that remains to be worked out in connection witn them and all others of the micro-organisms; and that is the necessity and possibility of a grouping together of the bacteria by the means shown to us in cultivations. In other words, the classification of bacteria must be, as it is now, of two kinds: first, according to the ideas of the cryptogamic botanists; and, second, according to the convenience of experimental bacteriologists. This latter method is the one of special interest to us as physicians, and to-day consists simply of the extremely rough separation into round bodies (micrococci), rod-shaped straight bodies (bacilli), and curved organisms (spirilla): this is as near to a classification as the bacteriologist can come at present if he depends upon the morphological appearances alone; but if we consider the difference taught by the review of the organisms just made, the same thing being shown with all others yet isolated and studied, we shall see the possibilities of a more satisfactory arrangement from a medical point of view. We see that there are *groups* of these organisms presenting very similar characteristics under the microscope, under cultivation, and more especially upon inoculation: in the latter case certain of them bring out almost exactly the same pathological changes when inoculated in the same way and with the same sort of animal. The lesions they give rise to are similar, but the organisms themselves are different as shown by cultivation, although these differences may not be very marked. Now, considering the micro-organisms to be plants—for their place in the scale of Nature seems undoubtedly to be in this part of her kingdom—it appears not improbable that these "groups" of micro-organisms may be species of which each individual goes to make up a variety, just as in larger members of the same division of Nature there are varieties differing in minor points among themselves, but all possessing the characteristic elements of the family group. This idea, that bacteria, both the pathogenic and non-pathogenic members of the number already studied, possess certain elements in common, bringing them into certain families and dividing them off from others, must be especially prominent in considering those which produce the acute infectious processes rather than the chronic ones. Indeed, our knowledge of the processes running a prolonged course is extremely limited, so much so that it may be said to be confined to one disease, tuberculosis, in which the full chain of evidence required is complete, and therefore any idea of what the future may bring forth in regard to them must be based upon the merest guesswork. With the acute infectious diseases, however, it is different, and more particularly with those under special consideration. In this case we have several groups of organisms nearly alike as shown by the microscope and cultivation. These groups each produce a similar set of symptoms upon inoculation, and the probability of their near connection, as varieties of the same genus, is only strengthened by the most recent researches. These last have shown that, as before mentioned, it is possible to isolate from pure cultures of various organisms certain toxic principles which are possessed of very virulent powers, these powers resembling, in the results that are produced on inoculation, those of the organism grown in the nutrient media in which they are found. These toxic principles are for the most part exceedingly complicated and very unstable, so that they are difficult to isolate or to analyze. But enough is now known about them to show that they are the results of the growth of bacteria in different media, of which the animal tissues are of course the most perfect kind for the pathogenic bacteria, and that they are the result of new chemical combinations made possible by the breaking up of the materials from which the bacteria have absorbed the elements necessary for their own development. These toxic principles exist as the result of most forms of bacterial growth, and, so far as known, produce by themselves the results shown when the organism is itself present and multiplies. Are they, then, capable of being classified together chemically, as we have just seen that certain forms of bacteria may be physiologically, and do these "groups" of bacteria produce the same toxic principles? These are questions that our present knowledge does not permit us to answer with any degree of definiteness, but they are certainly parts of the vast problems in medicine that modern research has opened up for settlement.

Although our knowledge of the ptomaïnes and leucomaïnes is so slight compared with what it should be, and will be before many years, that it must almost be said to be none at all—a mere knowledge of the existence of this new field of research—nevertheless, no thorough comprehension of disease can be had from a modern point of view unless we know what they are and what they are supposed to do. The fact that it was impossible in many cases to imagine a channel of entrance made many observers hesitate to accept the assertions in regard to bacteria being the cause of disease. Thus they said, How do the micrococci found in ulcerative endocarditis gain an entrance to the seat of disturbance? They cannot be shown to have got in, and therefore they must be but the accompaniments and results, and not the cause, of disease. This, however, requires that all causes of infectious disease must be shown to have a place of entrance large enough or noticeable enough for us to appreciate by the ordinary senses; which is, of course, absurd. We cannot see masses of bacteria large enough to develop the most alarming symptoms, and it is hardly to be supposed that we can see the lesions necessary for their entrance into the animal tissues; and that we may not appreciate that the lesions present are th channel of entrance for the cause of the symptoms seen is shown by th fact observed, that bacteria do not always produce local effects at the point of entrance, but may give rise to general symptoms alone or to symptoms localized at a distance from the point of inoculation. Rosenbach's experiments, of making a simple fracture of the hind leg of a rabbit, and then inoculating the animal in the ear with the Staphylococcus pyogenis aureus, show this very well, the result of the experiments being the production of an osteomyelitis with abundant micro-organisms at the point of fracture, but no disturbance at the seat of inoculation: the organisms entered the solution of continuity and attacked the place of least resistance, made so in this instance by the intentional injury to the parts of the leg.

In approaching the subject we are about to discuss we are brought face to face again with the old question of the internal or external origin of infectious diseases. The former can hardly be supported to-day because, as has been said, the theory of spontaneous generation has been practically disproved and has no scientific basis upon which to stand, and, on the other hand, the absolute, conclusive proof of the production of every infectious disease by an external cause cannot be conceded until an organism has been found and identified for each and every one of these diseases. This has not been done, and probably never will be, but it is not necessary in several cases, and the more especially in those that are under present consideration. For we know enough now to be certain that not all diseases that have been separated and given names by their clinical signs are due to distinct causes; and, on the other hand, we know that many different causes may produce similar clinical symptoms. And this seeming necessity for the attachment of a special microbe to each special group of clinical symptoms is shown to be no necessity at all by the discoveries that are being made in regard to the products of their activity—the ptomaïnes and leucomaïnes. Medical men must come to the realizing sense of the fact that there must be a new classification of the infectious processes represented by the septicæmias and pyæmias, and that not only the clinical symptoms must be considered, but that the etiology of the processes is of even more importance. In this etiology are concerned, as recent investigations show, not only the bacteria themselves, as active factors in the production of pathological processes by the absorption of the elements necessary for their growth from the nutritious materials or even the cells of the animal tissues in which they find themselves, but also the class of alkaloids called ptomaïnes and leucomaïnes, of which comparatively little is known, although that little is quite sufficient to show their extreme importance in medicine. In considering this class of substances and studying their effect in the special processes under consideration, puerperal septicæmias and pyæmias, it is necessary to take as broad a view of the subject as is the case with the micro-organisms themselves. Because if, as we have endeavored to show, many forms of bacteria may be concerned in the production of these processes, it follows with equal truth that many forms of these toxic substances, the product of bacterial growth, may be equally concerned in causing these and similar results. But a difficulty in precise and pertinent statement comes in here for this reason. The study of the individual bacteria and of the lesions in which they are found has not been carried so far that it is possible to state what special form of alkaloid each organism produces, or even whether the toxic products found in the nutrient material after they have grown there are single or multiple; so that, as yet, we are unable to say of a bacterium that it produces such and such alkaloids which will have such and such effects upon introduction into living tissues. This much is known, however: that there are certain substances found in media which have been the seat of the growth of bacteria, and in all such media that have been properly investigated; that these substances are alkaloidal in nature, and possessed of exceedingly powerful toxic properties; that they often occur in numbers of two or three or more in the same nutrient media; and that many of them are so unstable that the use of the processes of extraction yet known only serves to decompose them into simpler substances which may be inert. This instability of character naturally renders the difficulties of this branch of study very great, and the probabilities are that new methods of investigation must be applied before our knowledge in this direction becomes extensive or very exact. That these new methods of investigation will come is not too much to hope, and that their arrival and application will have as great an effect in increasing our knowledge in this direction as Koch's methods of pure culture have already had upon our knowledge of the bacteria is practically certain. In order to a complete understanding of the subject a review, as brief as may be, of our present knowledge in regard to the ptomaïnes and leucomaïnes is very necessary.

From the time of the researches of Selmi in 1872 the name of ptomaïnes has been given to the alkaloids obtained from the putrefying cadaver; and since then Gautier has shown that these animal alkaloids can also form in the living organism and as physiological products of the living cell. To these latter the name of leucomaïnes has been given; and in the same way as the vegetable cell produces the vegetable alkaloids quinine, digitaline, morphine, strychnine, etc. do the animal cells give rise to the animal alkaloids which are more or less toxic in character. The history of the study of these alkaloids in medicine may be summarized thus: After having found that the infectious diseases, in many cases surely, and in all probably, are produced in the first instance by the entrance into the body of the various forms of micro-organisms, a search was made for the method of action of these destructive bacteria. As has been well said,[1] the pathological changes produced by infectious bacteria can be conceived of as resulting in two ways: They are either the result of the *mechanical disturbances* the organisms themselves produce, or else their noxious results follow the fermentations they set up; that is to say, that by this latter hypothesis they give rise to true intoxication following this production of toxic substances. But pathological anatomy has left but little importance to suppositions of the first order; the actual mechanical effects of the bacteria are comparatively not many, whilst, on the other hand, the clinical observations of thermometric changes, disturbances of the intellectual faculties, and of the general bodily functions show very clearly that infected tissues are the seat of abnormal chemical changes, of which the toxic products are the cause of the symptoms observed at the bedside; and these products are the leucomaïnes. The question is still undecided, however, whether these pathogenic alkaloids, these "ptomaïnes found in the living body," these leucomaïnes, are in all cases the accompaniments of bacterial activity, or whether they may be formed by the combination of circumstances aside from the presence of the living organisms; but the facts observed and the analogies to be drawn from them point with the strongest probability toward their being due to such activity, and to their not being formed in a healthful animal organism excepting under the influence of the presence of living ferments.

Brieger[2] says that bacteria produce chemical decompositions in the animal body, and they do, acting in these two ways: 1, by taking for their own use elements which are of importance to, and necessary for, the nutrition of the animal economy; 2, by producing in the tissues that they infiltrate fermentations which result in the separation of certain toxic products of complex character. In a word, they give rise in the animal organism to products of putrefaction, just as cellular life itself produces the same thing in the animal. It is this *vital processus* which brings on death, and which gives rise to the cadaveric alkaloids as to the alkaloids found in the fluids during life; in a word, life is a decay (*pourriture*), and a fermentation of the colonies of cells which make up the animal organism, or of the cells which invade and besiege it (pathogenic bacteria), produces ptomaïnes or leucomaïnes.

Gaspard and Stich in 1822 observed poisonous properties in cadaveric extracts, but Panum in 1856 was the first to isolate a putrefactive poison whose effects could be compared with the venom of serpents. O. Weber, Hemmer, Sweninger, Stich, and Thiersch concluded from their researches that the poison of putrefaction was of a chemical nature, but were unable to isolate it. Dupré and Bence-Jones in 1866 obtained from animal tissues and fluids an alkaloidal substance to which they gave the name of animal quinoidine. Bergmann in 1868, at first alone and then with Schmiedeberg, obtained an azotate crystalline substance from putrefied yeast of beer which they call sepsine, and which they thought they discovered later in septicæmic blood. Sonnenschein and Zulzer in 1869 isolated from the anatomical maceration-fluids an alkaloidal base analogous to atropine and to hyoscyamine, and in 1871 Roersch and Fassbender during certain medico-legal experiments obtained a substance presenting alkaloidal reactions from the liver, spleen, and kidneys. About the same time Schwanert obtained an oily material from the cadaver smelling of propylamine; Marquardt and Hager isolated a substance analogous to conicine, to which Hager gave the name of septicine; A. Gautier discovered a volatile cadaveric conicine, and B. Liebermann and Brands-Krebs found the same thing later (1874). A little later than this Brouardel and Boutmey found an alkaloid analogous to conicine in the bodies of many persons poisoned by eating stuffed goose, and a ptomaïne analogous to veratrine in the organs of other subjects. Wolkenhaar, Moriggia, and Battistini—Selmi especially, and after him Brugniatelli, Zenoni and Cortez, Dragendorff, Spica, and many others—announced the existence of alkaloids of putrefaction in many important articles. Brugniatelli, Zenoni, and Cortez showed the presence of narcotic poisons and of a base resembling strychnine in corrupted maize. Selmi by the method of Otto-Stas, Dragendorff and Spica by a method of their own, obtained numerous substances with alkaloidal reactions from the organism; Coppola obtained them from fresh blood, Bechamp from the products of stomachic and pancreatic digestion, Gautier, Baldinnio, Bocci, Schiffer, and Bouchard from human urine. But not one of these writers had succeeded in isolating the ptomaïnes which they had discovered, nor in giving them fixed chemical individualities, and they had not given their composition. This part of the history of the ptomaïnes begins with the work of Nencki, A. Gautier,[1] Étard, Guareschi, Mosso, Maas and Willgerodt, and Salkowsky. Von Nencki was the first to obtain from putrefying gelatin an alkaloidal base which had the power of combining with an acid to form a crystalline salt: this was Nencki's "collidine." Following him, A. Gautier and Étard obtained two alkaloidal bases capable of giving crystalline salts from putrefying mackerel—collidine and parvoline ($C_9H_{13}Az$). These are all the alkaloidal salts of putrefaction that were actually isolated before Brieger's work. This investigator discovered successively the ptomaïne of peptone (peptotoxine), which produces death by cardiac paralysis; the ptomaïnes of putrefying meat (cadaveric ptomaïnes), guanidine $C_5H_{15}Az,O_2$; neuridine, $C_5H_{14}Az_2$; cadaverine, $C_5H_{16}Az_2$; putrescine, $C_4H_{12}Az_2$; saprine, $C_5H_{16}Az_2$; trimethylamine, $(CH_3)_3Az$; and mydaleine; and of these alkaloids some are toxic and others not. These are not the only bodies that can be obtained from putrefied infusions of meat, fish, cheese, etc. All of these materials yield a series of extracts with alkaloidal reactions and different colors and precipitates. In fact, one can with the alkaloidal reactions demonstrate the existence of a large number of substances resembling vegetable poisons without ever indicating their chemical character, so that the general reaction for ptomaïnes, as indicated by Brouardel and Boutmey (a blue color upon the addition of ferrocyanide of potassium and perchloride of iron), is of no value for indicating that great alkaloidal group, the ptomaïnes, any more than the one given later by Bettrick and Dissel. There are special but no general reactions for ptomaïnes: if phosphomolybdic acid gives a precipitate with all the ptomaïnes, it is because this agent precipitates almost all ammonia compounds under any circumstances. Many of the ptomaïnes are not well determined, but those spoken of last are best known, so far as their chemical composition, characteristics, and toxic effects are concerned. The origin of these ptomaïnes lies in their formation at the expense of proteid material and under the influence of the life-activity of the ferments and tissues.

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[1] "Action des Microbes dans les Maladies," *Revue scientifique*, Nov. 15, 1884, p. 619.

[2] *Ueber Ptomaïne*, Berlin, 1885.

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[1] *Chemie appliquée*, t. i. p. 253, 1874.

Brieger has shown that the cadaveric alkaloids only form in the time of the beginning of putrefaction, to disappear upon its continuation. He has proved that neuridine is formed during putrefaction—a substance that cannot be extracted from albumen or fibrin; and, whatever the special chemical reactions are, putrefaction produces neuridine and cadaverine toward the third day, putrescine on the fourth day, mydaléine about the seventh day, and so on; for it is shown that the different stages of decomposition of dead organs are marked by the formation of basic products, and that many ptomaïnes disappear with time and are replaced by others. These compounds, although so powerful in their toxic action, are nevertheless, to a certain extent, limited in that action by several facts; their instability renders them especially liable to being broken up into simpler and more harmless compounds; and this is assisted by the continual oxidation going on in the living, and by the presence of the animal heat, which is another element in the production of change in these alkaloids.

In brief, if it be true that the bacteria of putrefaction are capable of producing a variety of ptomaïnes, some toxic and others not—and this fact is put beyond a doubt by the researches of which we have just spoken; if it be true that this production takes place either directly at the expense of the tissues, or at the expense of non-organized material, albumen, which is not less certain for the same reason; finally, if it is true that this formation of alkaloids is the result of a simple doubling up or a complete destruction of these first materials, whose elements then engage in the synthetic reproduction of the ptomaïnes;—if all this be true, we should expect the pathogenic bacteria to possess this power in the highest degree. And it is just this power that they are shown to have by the researches of Brieger, A. Gautier, Villiers, G. Pouchet and Bouchard, and many others.

The difficulty of obtaining pure ptomaïnes has forced experimenters to use generally ethereal and other extracts, which they transform into sulphates and hydrochlorates, with which more or less impure salts the effects upon animals have been studied. Free ptomaïnes present sometimes a cadaveric and sometimes a uriniferous odor—when not oxidized a virulent odor, such as that of conicine or pyridine. At other times they have an agreeable odor, like orange-flower water, rose, or musk. Most of them possess a sharp taste, which helps toward strangulation if the dose placed upon the tongue be very strong. Some of them are extremely bitter.

The physiological effects (speaking very generally) on frogs are—*a*, dilatation of the pupil, followed by contraction; *b*, tetanic contractions, followed by muscular relaxation; *c*, loss of cutaneous sensibility; *d*, loss of muscular contractility. When dogs are used there is—*a*, irregular and then contracted pupil; *b*, remarkable hyperæmia of the vessels of the ear-flap; *c*, a very slow respiration; *d*, somnolence and stupor, followed very soon by convulsions and death; *e*, loss of muscular contractility.

The other class of animal alkaloids, those formed during life—the leucomaïnes—are of especial importance from the point of view of clinicians, and should be divided into two groups: those found during normal life, or in health, and those formed during abnormal life, or in disease. As long ago as 1849, Liebig, and after him Pettenkofer, found créatinine in the urine of man and of the dog, but not much was done in the way of following up the meaning of this discovery; and although créatine was found in the tissues, and it was known that it could produce the former by simple dehydration under the influence of salts, acids, or heat, the influence of this property in presenting créatinine in the urine was not recognized; for the same objections were brought against créatine as are now brought against the results obtained in the investigations of the ptomaïnes and leucomaïnes—that they are the *products* of the processes to which the animal substances are subjected during extraction, and were not present in the original materials at all.

In 1869, Liebreich found bétaïne ($C_5H_{11}AzO_2$) in normal urine, and, in 1880, Pouchet found several alkaloids besides this in the urine.[1] Gautier a year after, and Bouchard[2] in 1882, both contributed to this study, and Bocci[3] showed the toxic properties of the urine by many interesting studies. Munson and Schagdenhauffen[4] found an alkaloid present in very small proportion in human amniotic fluid, and Lepine and Guerin[1] succeeded in extracting a certain number of ptomaïnes from certain pathological processes. Gautier, Bouchard, and Villiers all made elaborate researches, the results of which go to show that the animal organism, even in perfect health, produces ceaselessly, and by the very fact of its cell-life, virulent poisons, and that if it does not poison itself constantly, it is only on condition that this production is not abnormally active and that the secretory functions are perfectly performed. There seems to be no doubt at all of the existence of a marked analogy between the products of putrefaction and the results of intra-organic combustions; so that the bacterial destruction of animal tissues can give rise to bases called ptomaïnes, and in the living body the cells which make it up, when deprived of the influence of the oxygen of the air, can act like ferments and give rise to other alkaloidal substances called leucomaïnes. There is the same point of departure, albumen, in both processes; there are the same definite terms, carbonic acid, ammonia, phenol, indol, scatol, fat acids, xanthine, sarcine, phosphorus, sulphur, hydrogen, etc.; and in both alkaloids are found. If it be true that bacteria of putrefaction are capable of giving rise to a long series of ptomaïnes, some toxic and others not; if it be true that this production can be made directly at the expense of the tissues or at the expense of the albumen; if it be true that the formation of these alkaloids is the result of a simple doubling or molecular disintegration, after which the atoms pass at once to the synthetic production of the ptomaïnes; lastly, if it be true that the living cell is itself capable of producing toxic alkaloidal bodies in perfect health;—if all this be true, we should certainly expect to see diseased bodies and the pathogenic organisms possessed of this power in the highest degree; and this is precisely what modern investigation is showing. Is showing, because we have not yet got far enough to know the actual reactions set up by bacteria in the animal body, and have merely indications of what occurs in a few cases. We know that certain of them have the power of liquefying gelatin, that some of them give rise to gas-production, and that others may set up a putrid fermentation; but we do not yet know much of the products of the combinations or separations set up by these bacteria. Passet has found that certain of the organisms he obtained from pus produced cultures which were capable of coagulating sterilized milk. Harnnek and Passet considered this coagulation to be the result of lactic fermentation. In fact, they established the presence not only of lactic acid, but of certain volatile fat acids in the milk coagulated by the Staphylococcus pyogenis aureus and S. p. citreus.

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[1] *Thèse de Paris*, 1880, p. 21. [2] *Leçons sur les Intoxications dans les Maladies*, 1887.

[3] *Cent. f. d. Med. Wiss*, 1882, No. 51. [4] *Comptes Rendus*, Oct. 30, 1882.

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[1] "Sur la Presence d'Alcaloides toxiques dans l'Urine et dans Certaines Liquides pathologiques," *Rev. de Méd*, t. lvi. p. 767, 1884.

Brieger observed that Friedländer's pneumonia-bacillus produced ormic acid at the expense of the carbohydrates, and especially acetic cid and ethyl alcohol, and he found that a bacillus which he obtained rom human feces, and which always killed guinea-pigs, produced pro- ionic acid in the presence of grape-sugar. This author has done more han any one else in the line of investigation of the pathogenic organ- sms. In cultures in various media of the typhoid bacillus, besides thyl alcohol and volatile fat acids, he obtained a base which formed alts with the chlorides of gold and platinum, and which he considers triamine.

It is perfectly evident that the animal organism attacked by, for xample, septicæmia is the seat of very different chemical reactions rom those which occur in health; and Brieger has shown this by roving that in diphtheria, erysipelas, pyæmia, and scarlatina phenol s eliminated in much greater quantity than in health.

Very much more information has been gathered, and all tending in he same direction, by Bouchard,[1] Felz,[2] Lepine and Aubert,[3] Villiers,[4] ouchet,[5] LeBon;[6] and one of the most interesting discussions upon he bearing of these discoveries on modern medicine may be found in he *Bullëtin de l'Acad. de Méd.*, 2ème Serie, t. xv. No. 5, p. 175 *et seq.*, 886.

This review of the ptomaïnes and leucomaïnes is necessarily exceed- ngly brief and unsatisfactory, so far as completeness is concerned, but t will perhaps serve the purpose for which it was intended. That urpose has been, in the first place, to show how vast the subject really s, and how little of it our knowledge embraces; secondly, it has been he desire to bring out these great points, that both living and dead nimal tissues are the factories of poisons of great virulence; that in lead tissue these poisons are produced by the micro-organisms, whilst n living tissues they are produced by the vital activity of the cells hemselves or of the bacteria among these cells; that the production f these toxic substances during life does no harm, but that they pro- luce poisonous symptoms as soon as their excretion is interfered with r their production is abnormally increased; that the first of these con- litions, obstruction to excretion, may occur from various causes, but hat both increased production and obstruction to excretion may and lo occur upon the entrance of bacteria into the living tissues and their levelopment there. This last point is the gist of the whole matter, and s precisely what occurs in infectious diseases, and especially in those f a septicæmic or pyæmic nature.

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[1] *C. Rendus de la Soc. de Biol.*, 1882, Aug. 5.

[2] *C. Rendus de l'Acad. des Sciences*, 1886, Avr. 12, et 1887, Juin 27.

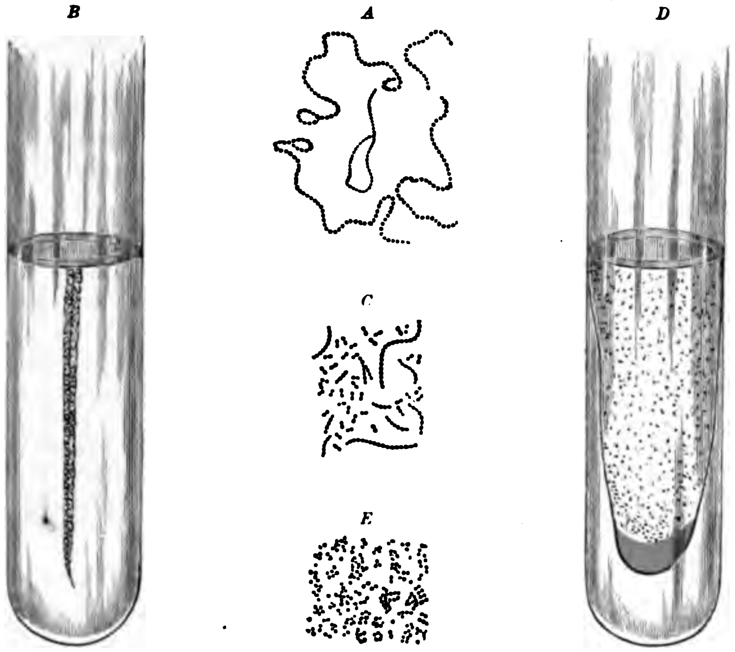
[3] *Lyon méd.*, 1885, Sept. 27.

[4] *C. Rendus*, 1885, Jan. 12, Avr. 20, Mai 11.

[5] *Ibid.*, 1885, Jan. 26.

[6] *Ibid.*, 1885, Sept. 21.

FIG. 107.



A.—Cover-glass Preparation of a Pure Culture, grown in bouillon at 37° C., of the Streptococcus erysipelatis. × 950.

B.—Needle-culture of the Streptococcus erysipelatis, grown in nutrient gelatin at 16° to 18° C., four days old. Natural size.

C.—Cover-glass Preparation of a Pure Culture of the Staphylococcus pyogenes aureus, grown in nutrient gelatin. × 950.

D.—Pure Culture of the Staphylococcus pyogenes aureus in nutrient gelatin after eight days at 16° to 18° C. Natural size.

E.—Cover-glass Preparation of the Streptococcus pyogenes, from a pure culture in nutrient gelatin. × 950.

The body is in health; a wound occurs, as in a woman during parturition; pathogenic bacteria enter and flourish. If they flourish, it can only be by the taking up of nutritious materials required for the cells of the tissues; and this absorption goes on in unusual activity, it may be from the tissue-cells themselves, or it may be from the nutritious materials brought to the spot by the lacteals or other channels. In either case the result is the same, and there exists an unusual quantity of elements in a condition of unstable equilibrium, which, following the universal chemical law, seek new affinities and form new compounds, these compounds being, in part at least, of a toxic character and serving to produce the symptoms seen in disease.

The desire has been to show in this paper the nature of the so-called "puerperal fever" as it appears in the light of modern research; and the effort has been made to show—I. That puerperal fever is not a "specific" process, but only one form, from a clinical point of view, of an infectious wound-disease; II. That these infectious wound-diseases are never endogenous, but always exogenous, in origin; III. That they are produced in all cases by the action of living ferments, but that this action may be either direct (destruction of tissue or mechanical obstruction) or indirect (by the production of leucomaïnes, with the resulting toxic effects of these animal alkaloids produced during life).

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SOME COMPLICATIONS OF THE PUERPERAL STATE INDEPENDENT OF SEPTIC INFECTION.

By BARTON COOKE HIRST, M. D.,

PHILADELPHIA.

ABNORMALITIES IN THE INVOLUTION OF THE UTERUS AFTER CHILDBIRTH.

An abnormal course in the return of the uterus from the post-partum condition to the ordinary dimensions and weight of a non-gravid womb may manifest itself by excess or defect: there may be superinvolution or subinvolution; and these abnormal degrees of a natural process may be seen in cervix and body, in peritoneal, vascular, muscular, mucous, and connective tissues.

SUPERINVOLUTION.—This condition is the result of an abnormal prolongation, or an exaggeration of that process by which the gravid womb returns, after delivery, to the dimensions of a healthy uterus in a woman not pregnant, in consequence of which this organ is left, some time after labor, smaller than in its virgin state. Sir James Y. Simpson first directed attention to morbid deficiency and morbid excess in the involution of the uterus after labor: since his time many writers have called attention to deficient involution; a smaller number have described the rarer anomaly of the two—excessive involution. Trommel detected superinvolution in 29 of 3000 cases; Simpson[1] saw it in 22 out of 1300 cases; Sinclair,[2] in measuring 108 uteri after childbirth, found in 22 instances a uterine cavity of less than 2¼ inches; and Fordyce Barker[3] has declared that he sees from one to three cases every year, and that in his opinion this abnormal condition constitutes about 1 per cent. of uterine diseases. Hansen[4] among 120 nursing women found 2 with a uterine cavity below 6 cm. (5.6, 5.4 respectively) at the eighth and tenth week after delivery. Johnson[1] gives an account of three cases which occurred in his practice, and Simpson[2] refers to those described by Chiari, Chiarleoni, Jaquet, and Whitehead. An interesting case after abortion has recently been reported by Dr. C. M. Hansen[3] of Minnesota.

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[1] A. R. Simpson: "Superinvolution of the Uterus," *Tr. Edinburgh Obstet. Soc.*, 1882-83, viii. p. 88.

[2] *Tr. Am. Gyn. Soc.*, vol. iv. This series of measurements, as well as others made later by Sinclair and Richardson (*Tr. Am. Gyn. Soc.*, vols. vi. and vii.), are sharply criticised by Hansen, who declares them to be in great part incorrect: the criticism is apparently merited.

[3] *Tr. Am. Gyn. Soc.*, viii., 1883, discussion on Dr Johnson's paper.

[4] "Ueber die puerperale Verkleinerung des Uterus," *Ztschr. f. Geburtsh. u. Gyn.*, xiii. S. 16.

The etiology of the condition is somewhat obscure. It might be ascribed, as Simpson says, to wasting diseases, as phthisis, cancer, etc.; to anæmia from hemorrhage at a previous birth or miscarriage; to nervous derangements, as puerperal insanity or chorea; to over-lactation; to a rapid succession of labors; to local inflammations, especially those which attack the ovaries and abrogate their functions. The degree to which the superinvolution may occasionally progress is surprising: A. R. Simpson reports a case in which the uterine cavity measured but a quarter of an inch, and Whitehead[4] saw a still greater reduction in the size of the uterus and its appendages after labor.[5]

Subinvolution.—Subinvolution may be described as an arrested or a retarded involution of the puerperal uterus. With such a definition it is requisite to clearly comprehend the normal process of involution before attempting to understand the conditions that may interfere with its natural progression. Unfortunately, however, this is still one of the unsolved problems of obstetrics as regards, at least, the reduction of the chief constituent part of the uterine body, the muscular tissue. Three theories may be advanced to account for it: (1) A fatty degeneration of the muscle-fibres and the absorption of the fine granular fat-globules to the complete destruction of the uterine muscle, its place being taken by a new growth of muscle-fibres developed from the embryonal muscle-cells in the outer layers of the uterine musculature. (2) An atrophy of the large muscle-fibres seen in a pregnant uterus at term. (3) The conversion of the muscle-cell contents into a peptone, its absorption into the blood-current and discharge through the kidneys, giving rise to the peptonuria of puerperal women (Fischel).

Kilian,[6] in his examination of rabbits' uteri thirty to thirty-six hours after they had expelled their young, found fat-globules in the epithelial covering of the uterus, noticed that the muscle-fibres looked fainter and paler than in pregnancy, and saw in their interior very fine shining fat-globules: alongside of these degenerated muscle-fibres Kilian found some quite young fibres, as he had seen them in the uteri of young animals. Heschl[1] confirmed Kilian's observations, and went even farther in declaring that the muscle-cells were completely destroyed by fatty degeneration; this writer saw in the outer portion of the uterine body first nuclei; these, then developing cell-contents around them, gradually transformed themselves into typical unstriped muscle-fibres. Thus after labor the uterine muscle was destroyed and a new development of muscle-tissue occurred to take its place. Robin,[2] on the other hand, claimed that the involution of the uterine muscle is essentially atrophy of the individual muscle-cells. Kölliker[3] says that the involution of the puerperal uterus consists in a diminution in size of the contractile fibres in the muscle-layer, alongside of which may be seen fatty degeneration. Mayor,[4] from a study of 14 specimens dating from the first day after delivery till the ninth month of lactation, concludes that while the fatty degeneration of the muscle-fibres is more pronounced than Robin thought, it is far from having the importance that Heschl attributed to it: it does not seem, as this author believes, to cause the destruction of the muscular elements. Mayor, therefore, attributes to atrophy the predominant rôle in the involution of the uterus. Winckel[5] still holds that the reduction of the puerperal uterus is due to fatty degeneration. Sänger,[6] from the observation of 12 uteri obtained at periods varying from four hours to fifty-five days after labor, recognizes the fatty degeneration in the muscle-cells, but does not believe that they are destroyed.[7] Microscopic sections of 5 uteri in

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[1] "Superinvolution of the Uterus." *Tr. Am. Gyn. Soc.*, viii., 1883.

[2] *Loc. cit.*

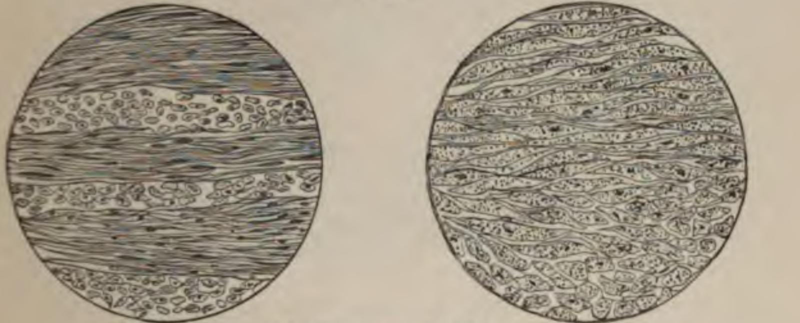
[3] *Medical Record*, Oct. 6, 1888.

[4] *Br. Med. Journ.*, October, 1872.

[5] For a description of the treatment and diagnosis of this condition see Vol. I. System of Gynecology.

[6] "Die Structur des Uterus bei Thieren," *Henle u. Pfeuffer's Ztschr. f. rationelle Medicin*, 1849 u. 1850, Bd. viii. u. ix.

FIG. 108.



Muscular Tissue of the Pregnant and of the Puerperal Uterus.

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[1] "Untersuchungen über das Verhalten des menschlichen Uterus nach der Geburt," *Ztschr. der k. k. Gesellschaft der Aerzte in Wien*, 1852, viii. 2.

[2] *Dict. encycl. des Sc. méd.*, 2e serie, t. x. p. 14. [3] *Gewebelehre*, 5te Auflage, p. 565.

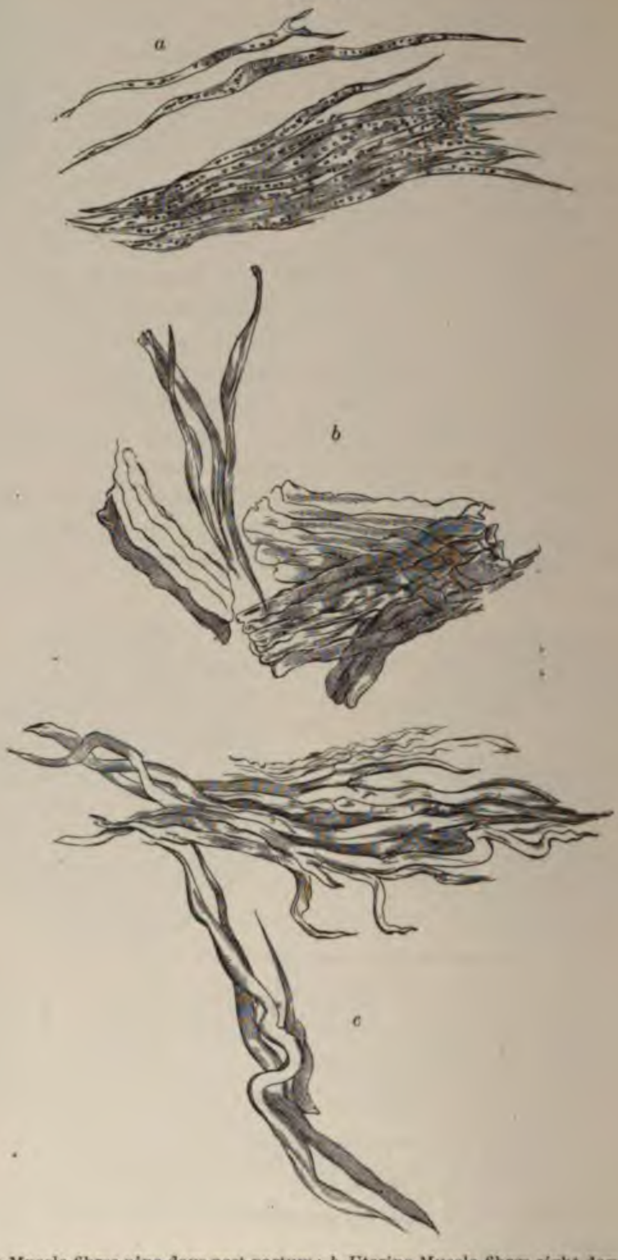
[4] "Étude histologique sur l'involution utérine," *Arch. de Physiol. norm. et path.*, ix., x., 1887, p. 560.

[5] *Lehrbuch der Geburtshülfe*, 1889.

[6] Abstr. in *Schmidt's Jahrbücher*, No. 3, 1888, p. 250.

[7] Sänger says that "the fat-globules and other degeneration-products do not enter, as such, into the circulation, but are oxidized on the spot. There is no such thing as a puerperal lipæmia" (*Die Rückbildung der Muscularis des puerperalen Uterus*).

FIG. 109.



a, Uterine Muscle-fibres nine days post-partum; *b*, Uterine Muscle-fibres eight days post-partum; *c*, Uterine Muscle-fibres in the eighth month of pregnancy.

my possession, obtained respectively in the last week of pregnancy, two hours, thirty-six hours, seventy-two hours, and seven days after confinement, would certainly seem to indicate that fatty degeneration plays a most important part in the reduction of the large muscle-cells characteristic of pregnancy to the much smaller muscular fibres of the unimpregnated womb. My own belief is that the redundant material within each cell is destroyed by some degenerative process (chiefly fatty), but that the cell is not destroyed *in toto*. Recent measurements made by Sänger[1] show very plainly that the reduction of the uterus after labor is effected by a diminution in the size of the individual fibres, and not by their destruction.[2] There is a greater unanimity of opinion in regard to the involution of the serous covering, connective tissue, blood-vessels, and mucous membrane of the puerperal uterus.

Mayor[3] found in the peritoneal covering of the uterus after delivery a number of folds in the membrane: at the bottom of these folds the endothelial cells seemed to be transformed into a spherical shape. Kilian[4] found the cells in this region infiltrated with fat-globules. Bernstein,[5] in a study of involution in the rabbit's uterus, paid especial attention to the behavior of the connective tissue: he found that the reduction of this tissue in the puerperal uterus was effected by a fatty degeneration of the connective-tissue cells, and by a drying out, as it were, of the connective-tissue fibres; these, deprived of the excessive blood-supply of pregnancy, dry up and shrink. Bernstein incidentally mentions the fatty degeneration of the peritoneal endothelium, and expresses the opinion that the muscle-cells, while they do undergo a fatty degeneration, are not completely destroyed.

The chief changes in the blood-vessels seem to be shrinkage, the obliteration of many large vessels by a connective-tissue growth in the intima, associated with fatty degeneration of the media,[6] and the development of new elastic fibres in the adventitia of the vessels not obliterated (Mayor).

The involution of the endometrium is now, thanks to the investigations, first of Friedländer,[7] then of Kundrat,[8] Engelmann,[9] Langhans,[10] Leopold,[11] and others, clearly understood. When the ovum is cast off

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[1] *Loc. cit.*

[2]

Fibre-length in pregnant uterus	208.7μ
" " in first few hours p.-p.	158.3μ
" " until the 4th day of the puerperium	117.4μ
" " in first half of 2d week p.-p.	82.7μ
" " in beginning of 3d week	32.7μ
" " at end of 5th week	24.4μ

[3] *Loc. cit.*

[4] *Loc. cit.*

[5] *Ein Beitrag zur Lehre von der puerperalen Involution des Uterus*, D. i., Dorpat, 1885.

[6] Balin: "Ueber das Verhalten der Blutgefässe im Uterus nach stattgehabter Geburt," *Arch. f. Gynäk.*, Bd. xv.

[7] Physiol.-Anatom. Untersuch. über den Uterus," Leip., 1870, *Arch. f. Gyn.*, Bd. ix.

[8] *Wien. med. Jahrbücher*, 1873.

[9] *Ibid.*

[10] *Arch. f. Gynäk.*, Bd. viii.

[11] *Ibid.*, Bd. xii.

at term, it carries with it, in the strictly normal case, the whole ovular or epichorial decidua and the upper cellular layer of the uterine decidua, leaving behind on the uterine wall the lower cellular layer and the glandular portion of the uterine mucous membrane. This membrane, deprived in great part of its nutriment by the contraction of the uterine wall and the obliteration of many of its blood-vessels, loses its vitality in that portion farthest removed from its source of nutriment—the

FIG. 110.

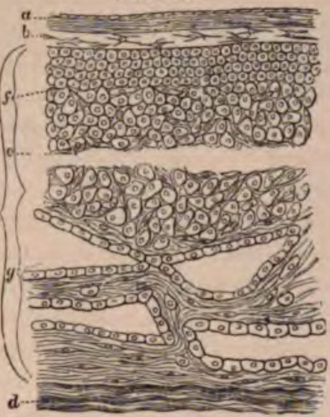


FIG. 111.

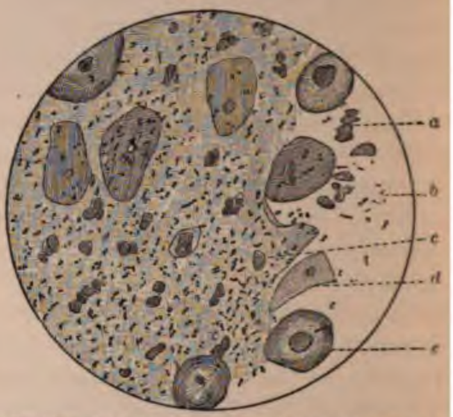


FIG. 110.—Diagrammatic Representation of Decidua (Friedländer): *a*, amnion; *b*, chorion; *c*, decidua; *u*, uterine muscle; *e*, line of separation in the cellular layer; *f*, cellular layer; *g*, glandular layer.

FIG. 111.—Lochia on Seventh Day: afebrile case: *a*, blood-corpuscles: *b*, diplo- and monococci; *c*, white blood-corpuscles; *d*, epithelium; *e*, decidual cells.

FIG. 112.

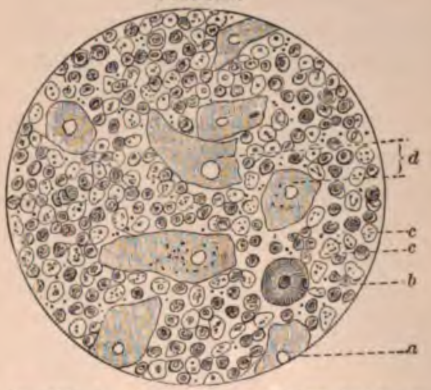


FIG. 113.

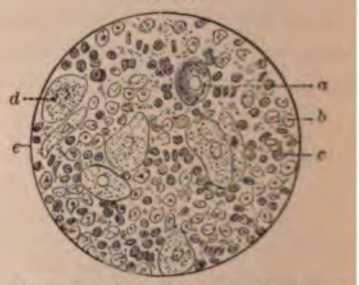
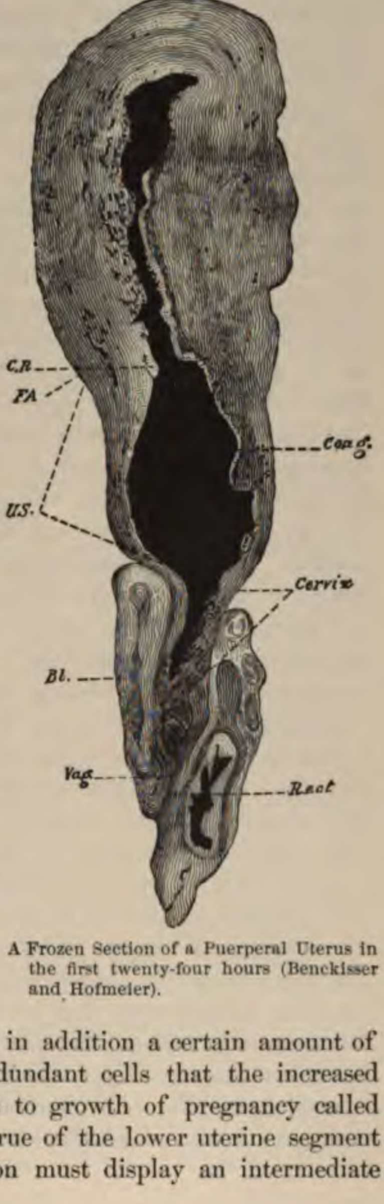


FIG. 112.—Lochia on the Second Day (lochia cruenta), showing a few cocci and streptococci (Winckel): *a*, decidual cells; *b*, red blood-corpuscles; *c*, *c*, white blood-corpuscles; *d*, epithelium.

FIG. 113.—Lochia on the Fourth Day: *a*, decidual cells; *b*, white blood-corpuscles; *c*, a few red blood-corpuscles; *d*, epithelium: *e*, micro-organisms (Winckel).

superficial layer of decidual cells. These die and are cast off with the lochial discharge in a condition of fatty degeneration or disintegration. By the shedding of these cells in time the glandular layer of the decidua is laid bare. Now the involution proper of the endometrium ceases and a regeneration of the membrane begins. The epithelial cells within the glands take on an active growth and reproduction; the interglandular connective tissue shares in this new development: by its growth it rises in embankments between the glands, making them deeper, and so in time reproducing the characteristic utricular glands of the uterine mucous membrane. This process requires some time. Mayor says: "On the twenty-fourth day after delivery I have not found glands in the region of the placental insertion. The mucous membrane, although reconstructed at the second month, is then furnished with fewer glands, less regularly disposed and of a greater calibre, than in the normal state."

FIG. 114.



A Frozen Section of a Puerperal Uterus in the first twenty-four hours (Benckisser and Hofmeier).

The uterus is not the only organ of the sexual system that experiences a retrograde change after labor. The ovaries and tubes, the broad and round ligaments, the pelvic connective tissue, blood-vessels and lymphatics, all undergo modification. That portion also of the birth-canal—the lower uterine segment, the cervix, the vagina, and the vulva—which is dilated to an extreme degree to allow the passage of the fœtal body, must likewise be subjected to rapid involution to regain its wonted tone and calibre. In these structures the process is mainly one of retraction of overstretched tissue; but there is in addition a certain amount of degeneration and atrophy of the redundant cells that the increased blood-supply and increased stimulus to growth of pregnancy called into existence. Particularly is this true of the lower uterine segment and cervix, which in their involution must display an intermediate process between that by which the reduction of the uterine body is effected and that by which the lower portion of the parturient tract regains its normal state.

The involution of the uterine adnexa will progress satisfactorily if the uterine involution itself is normal. The reduction of the overstretched vagina and vulva is sure to occur if these parts have not been seriously lacerated, although, like all overstretched muscular canals, they never quite return to their original calibre. The clinical study, therefore, of arrested or retarded involution of the genitalia in the puerperal state may be confined to the uterus.

Causes of Subinvolution.—There is still some difference of opinion in regard to the exact nature of the changes which occur in the individual muscle-cells during involution of the uterus: there can be no doubt as to the cause of these changes, whatever they may be. It is a great reduction of their blood-supply. In a general way, therefore, it may be asserted that any condition which tends to prevent a rapid diminution of the blood-supply to the puerperal uterus can become a cause of subinvolution. Nature's only method of decreasing the quantity of blood in the puerperal uterus is by the agency of the contracting muscle-fibres; therefore it may again be asserted that any condition which interferes with the contraction of the uterus will become a cause of subinvolution. It is necessary, in my opinion, to make these two broad divisions in the etiology of subinvolution, for, although frequently interdependent, they are not rarely, I believe, independent of one another. In point of frequency I would place first those causes which interfere with the decrease of the blood-supply to the uterus by attracting more blood to the organ after labor than is required during the normal process of involution. Prominent among these should stand hyperplasia of the endometrium. Possibly my own experience is exceptional in this particular, for in the two hospitals which are for a part of the year under my care the patients are either illegitimately pregnant, and have been engaged in efforts to conceal or to terminate their condition, or are recruited from the lower working-classes, and have had to endure privation and hard labor often during the whole of pregnancy. Certain it is that among such women subinvolution is very common, and is due, in my experience at least, most frequently to the retention of hypertrophied decidua within the uterus after labor. The first case of the kind which I saw, some years ago, was a primipara, illegitimately pregnant, who had endeavored to conceal her condition by tight lacing: fourteen days after labor the fundus stood not far below the umbilicus; the uterine cavity was scraped out with a curette, and quite two handsful of pultaceous deciduous membrane removed; within twenty-four hours the uterus had almost regained the size commonly seen two weeks after delivery. This experience has since been multiplied many times.

Subinvolution by an excess of blood-supply may occasionally be traced to the presence throughout the uterine wall of small fibroids. Recently two such cases have come under my notice: in one at the twelfth, in the other at the fourteenth day, the fundus still stood at the umbilicus; in neither of these cases were the fibroids large enough to have interfered with contraction, but in both instances exerted their influence upon involution by attracting too mnch blood to the uterus. An explanation of subinvolution by hyperæmia might be presented thus: The involution of the uterine muscle is due to the decrease of its blood-supply; the quantity of blood in the puerperal uterus is continuously diminished by the progressive contraction of the uterine muscle-fibres; when muscle-cells contract they burn up a portion of themselves in the effort put forth; the effete products of tissue-combustion are discharged into the venous system, while new material to replace what has been lost is absorbed from arterial blood. Physiologists say that during the contraction of a muscle all the blood-vessels within it are dilated, thus affording the greatest facility for the discharge from the muscle-cells of waste material and the absorption of new matter. In the uterus this arrangement does not obtain: the contraction of the uterine muscle necessarily diminishes very much the calibre of the blood-vessels, depriving thus the muscle-cells of the increased blood-supply which they require during action. Yielding, therefore, a vital portion of themselves to furnish the contractile force, surrounded by the products of their partial destruction, which are not carried off by the venous current, unable to resupply their lost constituents by absorption from arterial blood, the muscle-cells must undergo some degenerative process. But should there be some condition about the uterus which draws to it an abnormally great supply of blood, the muscle-cells can contract without such great detriment to themselves; their degeneration proceeds more slowly, is accomplished more imperfectly, than under ordinary circumstances. Other causes, besides the two already given, leading to this result, are lacerations of the cervix and periuterine inflammations, or inflammations of the uterine body and lining membrane, usually the result of sepsis; retention within the uterus of small fragments of placenta, shreds of membranes, placental or fibrinous polyps; chronic constipation, producing, as it will, pelvic congestion; and anything which interferes with the return of the venous blood to the heart, as increased intra-abdominal pressure, certain diseases of the liver, and valvular disease of the heart itself. From this last-named cause I have recently seen a most marked case of subinvolution. On the eleventh day the fundus stood halfway between symphysis and umbilicus; on the eighteenth day it still rested more than two fingers' breadth above the symphysis pubis.

Many conditions might be found to constitute that other cause of subinvolution—prevention of uterine contraction. Large intramural and submucous fibroids will do it; unusually large masses of hypertrophied decidua that sometimes develop at the placental site; the retention within the uterus of considerable portions of the placenta or of placentæ succenturiatæ; large blood-clots; the displacement of the uterus by a retroversion or flexion of the organ or by an overfilled bladder; peritoneal adhesions from old or recent inflammatory attacks involving the serous covering of the uterus and adjacent parts,—all may prevent effective uterine contraction after labor. One fact must stand out clearly from an experience in such cases: the cause of subinvolution is some local trouble and not a constitutional derangement. It must be every obstetrician's experience—it is certainly my own—to see the puerperal state complicated by many acute or chronic febrile affections, which do not, however, influence in the slightest degree uterine involution: thus I have seen typhoid fever, pneumonia, phthisis, eclampsia, general septicæmia where the point of entrance for the infecting poison was the rectum, and the uterus was not involved, and malaria in the puerperal state; and yet involution has gone on in a normal manner despite these constitutional complications and the fever that accompanied them.[1] One exception, however, must be made to this general statement: nervous derangements do influence involution. A. R. Simpson assigns to puerperal insanity quite a prominent rôle in the causation of superinvolution. On the other hand, a sudden mental shock, some powerful emotion, may arrest involution. One of my patients recently had quite a profuse puerperal hemorrhage on the seventh day, due, I think, to sudden uterine relaxation in consequence of the fright she experienced on hearing a stepson return to the house late at night in a violent state of intoxication.

Diagnosis.—This is easy when one is familiar with the normal progress of involution. According to Depaul, the fundus uteri should be a finger's breadth above the umbilicus on the first day of the puerperal state, higher than it is directly after birth; on the second day, at the level of the umbilicus; the third day, a little below; the fourth day, about the same; the fifth and sixth days, two fingers' breadth below; the seventh, eighth, and ninth days, three or four fingers' breadth above the symphysis pubis; the tenth, eleventh, and twelfth days, at the level of or a little below the pubes.[2] Hansen, after very careful measurements of 120 nursing women from the tenth day till the third month after delivery, gives the following as the normal course of involution from the tenth day of the puerperium until the process is completed:

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[1] Temesváry and Bäcker ("Studien aus dem Gebiet des Wochenbettes," *Archiv für Gynäk.*, Bd. xxxiii. H. 3, S. 331, 1888) actually make the assertion that fever favors the involution of the uterus.

[2] Parvin's *Obstetrics*, p. 532. For a more extensive bibliography of uterine measure-

		Average Intra-uterine Measurement.	Minimum.	Maximum.
10th day	(114 measurements)	10.6 cm.	8.0 cm.	13.5 cm.
15th "	(119 ")	9.9 "	8.3 "	11.5 "
3d week	(95 ")	8.8 "	7.5 "	10.5 "
4th "	(80 ")	8.0 "	7.0 "	9.3 "
5th "	(64 ")	7.5 "	6.5 "	9.0 "
6th "	(56 ")	7.1 "	6.2 "	9.1 "
7th "	(40 ")	6.9 "	6.0 "	8.5 "
8th "	(31 ")	6.7 "	5.6 "	8.5 "
10th "	(22 ")	6.5 "	5.4 "	7.5 "
12th "	(15 ")	6.5 "	6.0 "	7.5 "

In two-thirds of the cases Hansen found involution completed in six to ten weeks; in one-sixth, not until the last half of the third month or later; in again a sixth, within six weeks; the most rapid involution occupied four weeks. Any great deviation from this normal course may easily be detected either by abdominal palpation or by the use of a sound, while along with the arrest or retardation of involution will usually be found an excessive lochial discharge. Ahlfeld[1] claims that free perspiration after labor is a valuable sign of firm uterine contraction in the early part of the puerperal state: when it fails to appear he always looks for uterine relaxation.

Treatment.—Here, as elsewhere in medicine, the treatment should be directed not so much toward the symptom (subinvolution) as toward its cause. It is evident, therefore, that the treatment of this condition must vary greatly in individual cases. If the subinvolution depends upon the retention of hypertrophied decidua, a curette will promote rapid involution more effectively than anything else. If placentæ or membranes are retained in uteri, they should be removed. Where involution has been retarded by fibroids, the administration of ergot, strychnia, and quinine in pill form and the application of a faradic current have yielded good results. The bladder should never be allowed to remain distended with urine nor the rectum with feces. Inflammation in or about the uterus must be combated by appropriate treatment. If the heart-valves are imperfect and the abdominal and pelvic veins consequently engorged with blood, a heart tonic, as digitalis or strophanthus, will often assist involution. Charpentier has asserted that the routine administration of ergot in the puerperal state will hasten

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ments in the puerperal state see *Schroeder's Lehrbuch*, 8th ed., 1884, p. 230, and Hansen, *loc. cit.*

[1] "Die Zusammenhang zwischen Schweisseruption post-partum und Uterus-contractionen," *Ber. u. Arbeit. a. d. Geburts. Gynäk. Klinik zu Marburg*, 1885-86, Bd. iii. p. 81.

involution. This would seem reasonable, but clinical experience has not borne out the statement.

Herman and Fowler[1] did find, in experimenting on two sets of patients—one, 58 in number, which got an ergot mixture daily for a fortnight after labor, the other, 68 in number, which got a single dose of ergot after labor—that in the first set involution advanced more rapidly, but there was no difference in the lochial discharge. Dr. Boxall[2] also declared himself in favor of the routine practice of giving ergot during the puerperium, asserting that in two series of cases, comprising each a hundred—one treated without, the other with ergot—there were fewer blood-clots, these were more quickly discharged, and the after-pains were less in frequency, duration, and intensity in the latter series. Dr. Dakin,[3] however, dissented from these views, and claimed, likewise after testing the matter in practice, that the routine administration of ergot retarded involution by at least twenty-four hours. Blanc[4] also declares that the administration of ergotin during the first five or ten days of the puerperal state has not a favorable influence upon involution, but seems to interfere with it to some extent. As it is doubtful, therefore, whether ergot does aid involution, as there are many obvious disadvantages connected with its routine administration in the puerperal state, the adoption of this practice would be unwise.

PUERPERAL ANÆMIA.—This condition is placed after subinvolution of the uterus because it can, not inaptly, be called a subinvolution of the blood. After the first twenty-four hours of the puerperal state there begins a change in the constitution of the blood by which it is converted from the hydræmia of pregnancy to the normal proportion of its constituent parts in the non-gravid woman. At the end of two weeks this process is so far complete that the blood is more nearly in a normal condition than it was during pregnancy.[5] Many causes, however, may disturb the progress of this recovery from the hydræmia of pregnancy. Illness of any kind during pregnancy, hemorrhage during labor,[6] nervous affections, as insanity or chorea, during the puerperal state, kidney disease, fevers, etc., may all induce puerperal anæmia. The treatment of the condition must be governed by the circumstances of the individual case. The cause of the anæmia being removed, the blood will improve, and the improvement may be accelerated by tonic drugs and good diet. After hemorrhages beef tea, animal soups, and as nutritious a diet as the patient can bear, along with tonic medicines, will hasten recovery. Under the prolonged use of Blaud's pill I have seen the blood-corpuscles rise from less than three to nearly four and a half million per c. mm., and the hæmoglobin increase from 40 to 75 per cent. in a few weeks. In some cases arsenic alone succeeds where iron fails. Dr. Osler[1] has recently reported an interesting case of the kind.

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[1] "On the Effect of Ergot on the Involution of the Uterus," *Br. Med. Journ.*, 1888, i. 299.

[2] *Ibid.*

[3] *Ibid.*

[4] *Ann. de Gynéc.*, March, 1888.

[5] Meyer: "Untersuchungen über die Veränderung des Blutes in der Schwangerschaft," *Arch. f. Gynäk.*, Bd. xxxi. S. 145.

[6] It is extraordinary, however, to see how rapid occasionally is the recovery of puerperæ even from severest hemorrhage. A loss of 2000–2500 grammes of blood is usually fatal to an adult, but Ahlfeld reports two cases in which, respectively, 2000 and 2500 gr. of blood were lost without being followed by serious anæmia (*Ber. u. Arb. a. d. Geb. Gyn. Klinik zu Marburg*).

REPAIR OF THE INJURIES OF CHILDBIRTH.

Hand in hand with the progress of involution in the female genitalia after childbirth goes the reparation of injuries which every woman experiences in some degree during that process. Slight cracks in the mucous membrane, small rents in cervix, vaginal wall, and vaginal outlet, either unite firmly or else are healed by granulation. This is to be expected. It is surprising, however, to find occasionally very extensive injuries repaired by natural processes. Perforations of the vaginal vault, fistulous openings into bladder and rectum, deep tears and perforations of the perineum, transverse rents and perforations of the labia, lacerations about the urethra,—all have been known to unite without interference. Winckel says that perineal tears when left to themselves will be found healed in two and a half to five weeks. Extensive injuries, however, should be repaired, as well as may be, by sutures. Vaginal and cervical tears do not always require this treatment, unless there is profuse hemorrhage. In lacerations of the perineum it should never be neglected. If the stitches are inserted carefully primary union will be secured in 75 per cent. of the cases. Careless suturing leads to disagreeable consequences: in complete tears of the perineum I have seen recto-vaginal fistulæ left behind, and in incomplete tears perineo-vaginal fistulæ result from an imperfect union of the wound. In fistulæ the result of sloughs after labor, if the opening be not too large, a cure can occasionally be effected by touching the edges of the fistula with a strong caustic, like nitric acid. To do this the diagnosis must be made in the lying-in period. This, as a rule, is not difficult. The escape of feces and gas from the vagina and a constant trickling of urine point respectively to a recto-vaginal or a genito-urinary fistula. It is necessary in the latter case to exclude the incontinence of urine and the overflow of retention sometimes seen in the puerperal state. All doubt is cleared away by finding the anomalous opening between bladder or ureter and vagina or cervical canal. In case of septic fever in the puerperal state it is well to examine the abrasions and wounds along the parturient tract, and, if they have taken on an unhealthy appearance, especially if covered with a diphtheritic membrane, to cauterize them, preferably, I think, with nitric acid or acid nitrate of mercury.

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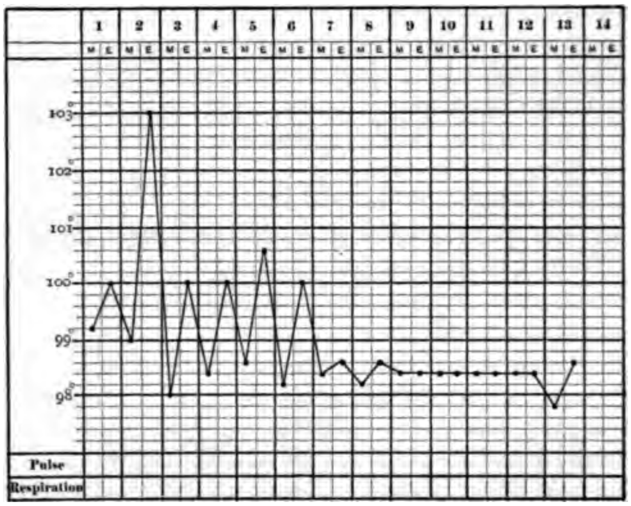
[1] *Boston Med. and Surg. Journ.*, 1888, p. 454.

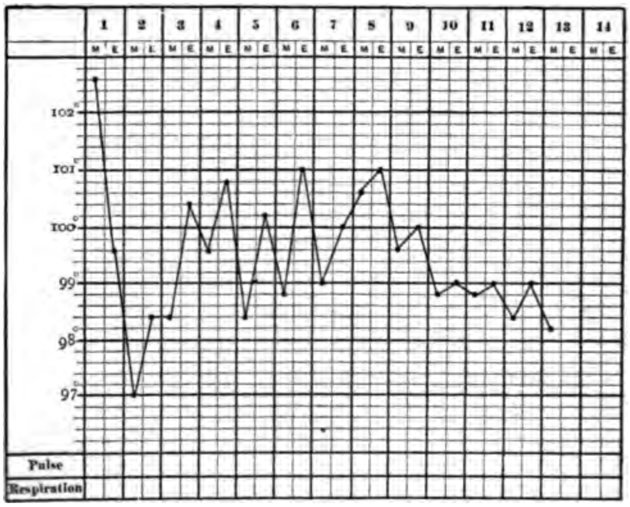
FIG. 115.



Bilateral Laceration of the Cervix with Subinvolution (Maternity Hospital).

Œdema of the external genitals, the result of injuries, pressure, or contusions during labor, gives rise to considerable pain and discomfort,

FIG. 116.



Deep Laceration of Anterior Vaginal Wall with Tarnier's Forceps (Blockley).

which are best relieved by the application of cloths wrung out in a hot antiseptic solution. The influence of injuries in the genital tract upon the course of the puerperal state is unfavorable. The danger of septic infection is materially increased, and fever is consequently more common, not only from this cause, but as a direct result of injury and irritation of tissue. In Fig. 115 I think this is well illustrated, although it is impossible to exclude absolutely septic infection from absorption. It must, however, be every obstetrician's lot to see cases guarded by strict antiseptic precaution which nevertheless have fever, to be explained by nothing else than the injury done the tissues during childbirth, and by the peculiar liability to abnormalities of temperature which is one of the essential features of the puerperal state. Fig. 116 is a good illustration of traumatic fever after childbirth. The subsequent elevation of temperature may have been septic, but this certainly cannot explain the rather high fever very shortly after labor.

Another consequence of injury to the vagina during labor is, according to Winckel, retention of urine. This author[1] says that he has seen obstinate cases of retention lasting from ten to fourteen days due to this cause.

PUERPERAL HEMORRHAGE.

The term "puerperal hemorrhage" is used to denote excessive bleeding from any point along the genital tract of the female occurring after the first day of the puerperium until involution of the uterus is completed—a period of about six weeks.

The causes of this accident are numerous, and should be well considered, for the treatment will be governed in most cases by a knowledge of the cause. An attempt will be made to place them as well as may be in the order of their frequency.

RETAINED PLACENTA AND MEMBRANES.

The retention within the uterus of the placenta, as a whole or in part, will very likely give rise to hemorrhage during the puerperal state. The retention of the whole placenta is not now a cause of puerperal hemorrhage, for no practitioner of the present day would allow this large mass to remain within the uterus many hours after delivery. Toward the end of the last century and in the beginning of this, however, it was not rare to find followers of William Hunter who trusted altogether to nature to deliver the placenta, often with most disastrous results. White[2] gives an account of four cases of retained placenta with fatal hemorrhage occurring on the first, second, third, and fourth days, respectively.

The retention of placental fragments is by no means a rare occurrence even now: a careful inspection of the placenta after delivery often shows a defect, and the missing piece will then be sought for and removed; but occasionally it is difficult or impossible to tell whether the placenta has come away entire; and if the retained portion is an accessory growth, there is, of course, nothing to indicate its existence. That the retention of placental fragments is not uncommon is shown most plainly by autopsies on puerperæ: Stadtfelt relates that in 70 such examinations there were found placental fragments in 7 cases, varying from the size of a hazelnut to that of an egg. Clinical observation would make this complication of the puerperal state appear more rare: of 2960 births in the Frauenklinik at Munich from 1884–87, there were reported 9 cases of retained placental fragments;[1] it is possible, however, that small portions of placental tissue might escape unnoticed in the lochial discharge, or else by their disintegration form a part of the discharge. The retention of placental tissue *in utero* does not always cause hemorrhage. I have seen a placenta succenturiata expelled on the second day of the puerperal state without any previous bleeding, and a very large piece of the placenta discharged four days after a premature birth, very fetid, but with no bleeding. In the 9 cases reported by Martini there was a prolongation of the bloody lochia in 1, a severe hemorrhage in 2; in 6 there was no excessive loss of blood.

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[1] *Lehrbuch der Geburtshülfe*, p. 741.

[2] *A Treatise on the Management of Pregnant or Lying-in Women*, Worcester, Mass., 1793, p. 215.

The cause of the retention of placental fragments is either some abnormal form of placenta (marginata, multiloba, succenturiata, etc.), an abnormal adhesion to the uterine wall, or too forcible or premature efforts at extraction or expression.[2]

Retention of the membranes after labor is of frequent occurrence. Martini reports 71 cases out of 2960 births.[3] Reihlen[4] found a retention of some portion of the chorion in 152 out of 3534 labor cases (4.3 per cent.). Another investigation gave 5.1 per cent. from an analysis of 11,381 births. Credé[5] reports 91 cases of retained chorion in 2000 births.

That membranes retained *in utero* may give rise to septic infection is now pretty generally admitted: whether or no they can be a cause of puerperal hemorrhage is still a disputed question. Credé[6] has expressed his belief that retention of the chorion is not at all dangerous. Olshausen has declared that the retention of chorion should never justify interference to extract it.[1] Reihlen[2] says that he never saw hemorrhage as a result of retained chorion. Schroeder[3] asserts that retained amnion and chorion practically never cause bleeding even when retained in toto. On the other hand, Winckel[4] and Hegar[5] have shown that retained membranes could give rise to puerperal hemorrhage as well as to septicæmia. Martini reports 28 cases of retained chorion in which there was no fever—that is, no pathological condition, as uterine inflammation, decomposition of thrombi, etc.—to account for bleeding, and yet among these cases there were 2 severe hemorrhages, 8 of minor grade, and 6 times a prolongation of the bloody lochia.

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[1] Martini: "Ueber das Zurückbleiben von Eihaut u. Placentarresten bei vor u. rechtzeit. Geburt.," *München. med. Wochenschr.*, 1888, 653.

[2] Ahlfeld in 996 deliveries saw only 4 cases of puerperal hemorrhage: he attributes the freedom from this accident in his clinic to his conservative management of the third stage of labor. He insists upon waiting one and a half hours before expressing the placenta (*Ber. u. Arbeiten*, Marburg, Bd. iii.).

[3] *Loc. cit.*

[4] "Zur Frage der Behandlung der Chorion-retention," *Arch. f. Gynäk.*, xxxi. 56.

[5] *Arch. f. Gynäk.*, Bd. xvii. S. 278.

[6] *Loc. cit.*

That retention of decidua can be an etiological factor in puerperal hemorrhage there can, I think, be no doubt. If the decidua is hypertrophied during pregnancy, the amount of tissue retained *in utero* may be considerable—as much in rare cases as a large portion of the placenta. This may act as a foreign body within the uterine cavity, preventing firm contraction, and so predisposing to hemorrhage, or else, adhering to the uterine wall, may attract an unnecessary amount of blood to the whole organ, with the same result. Even a small portion of deciduous membrane, as well as shreds of adherent chorion and amnion or placental fragments, may form the foundation of polypoid tumors reaching occasionally considerable size, composed chiefly of firmly-clotted blood or fibrin.

The growth of these bodies is quite like stalactite formation on stone. The same thing occurs, in different shape, when the placental site is left unusually rough and vascular. The blood, oozing from the sinuses, may deposit successive layers of fibrin until quite a thick mass is formed.

DIAGNOSIS AND TREATMENT.—The fact that a portion of the ovum has been retained *in utero* is usually easy to discover. A careful examination of the secundines after labor will enable one to detect missing parts which must have remained behind in the genital tract. It is not wise, as a rule, to invade the internal genitalia in order to remove small shreds of amnion and chorion; if, however, a great part of these membranes has been retained, it would seem to the writer advisable to remove it. The diagnosis of retained placenta is, as a rule, easy. When the whole organ remains *in utero*, the cord dangling from the external genitals points clearly enough to the condition. If one or more cotyledons remain behind, their absence may be noted from the placenta after its delivery. Occasionally, the diagnosis is more difficult, even if the whole placenta is retained. I recall a case in which a woman was delivered on her feet: the child dropped to the floor, the cord was dragged off from the fœtal surface of the placenta, and the latter

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[1] *Klin. Beitr. zu Gynäk. u. Geburts.*, 1884, S. 146.

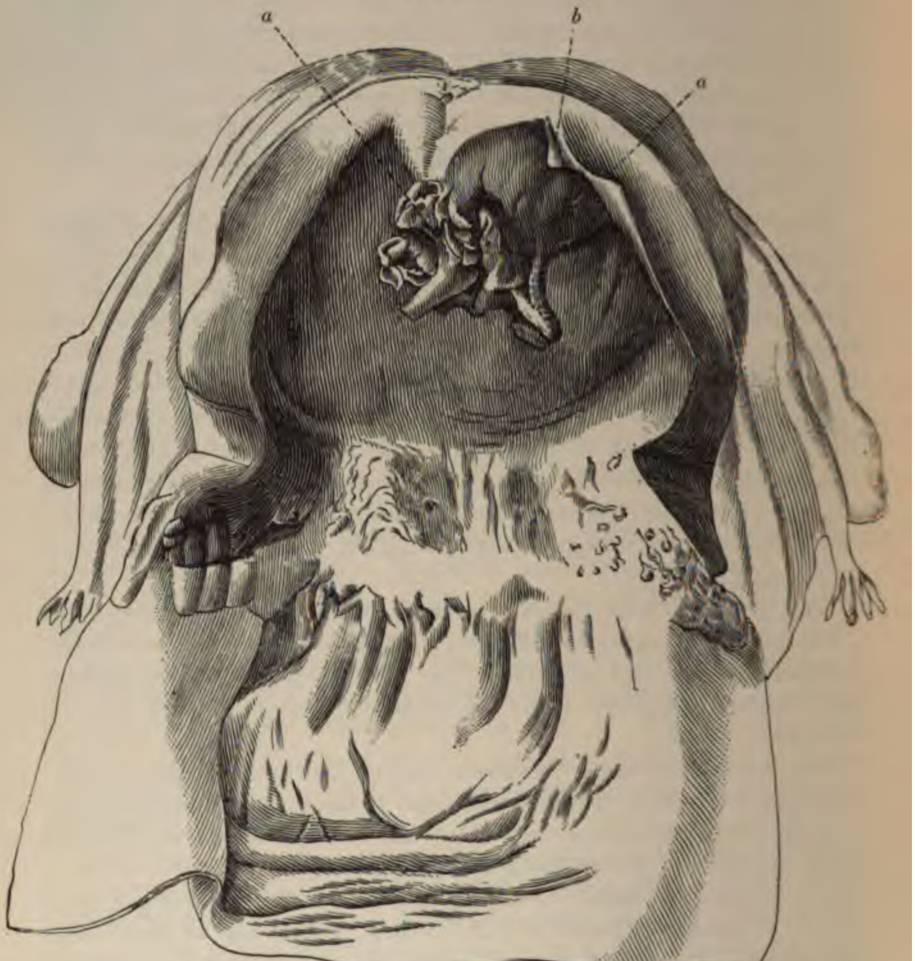
[2] *Loc. cit.*

[3] *Lehrbuch*, 10te Aufl. 797.

[4] *Berichte u. Studien*, 1874–79; *Path. u. Therap. des Wochenbettes.*

[5] *Path. u. Therap. der Placentar-retention*, 1862.

FIG. 117.



Fibrinous Polyp (Fränkel).

remained behind in the uterus; it was tightly adherent to the uterine wall, and its discovery, with no cord to guide one, was by no means an easy matter. It was finally peeled off and extracted, the woman meanwhile bleeding furiously.

Cotyledons torn off the periphery of the placenta may easily go undetected, and in certain roughly lobulated placentæ it is very difficult to be sure that no placental tissue has remained behind. If the medical attendant suspects the retention of placental masses after labor, he must attempt their removal. This is usually not difficult. The operator's hand—the only trustworthy instrument under the circumstances—is inserted into the uterine cavity, the placental substance felt for, caught by the fingers, and removed: if the placenta is adherent, the tip of a finger must be gently inserted, wherever most practicable, under the edge, and the whole organ gradually peeled off. If the uterine muscle is too firmly contracted to allow the introduction of the hand, the resistance must be overcome by firm, gradual pressure, first inserting one finger, then two, and so on till dilatation is effected. To accomplish this it is often necessary to administer an anæsthetic.

If puerperal hemorrhage occurs, the presence of membranes or placental fragments within the uterus should be suspected, and their removal be attempted unless some other condition is clearly seen to be the cause of the bleeding. To reach the uterine cavity after involution and retraction have made some progress, it is often necessary to dilate the cervical canal. Hegar's hard-rubber dilators will be found safest and most convenient for the purpose. Not rarely, however, the cervical canal remains patulous in consequence of the presence of a foreign body *in utero;* in this case access to the offending substance and its removal both become easier.

DISPLACEMENTS OF THE UTERUS.

The dislocation of the puerperal uterus will usually manifest itself in puerperal hemorrhage. Inversion, prolapse, displacements forward and backward and upward by a distended bladder, are all likely to be followed by excessive bloody lochia, if not by an active hemorrhage. Inversion and prolapse have already been considered; retroversion, retroflexion, and anteflexion will be discussed here.

Hemorrhage is likely to occur in these displacements as a result of the passive congestion always seen associated with them, due to interference with the venous circulation; or the bleeding may be the consequence of the retention of blood within the uterine cavity, due to the mechanical interference with its escape: in the latter cases clots are formed, increasing gradually in size, often undergoing putrefaction, and acting not only as a foreign body, preventing uterine contraction, and attracting by their irritating action an extra amount of blood to the uterus, but constituting as well a favorable nidus for the development of septic germs, which may extend their operations to the thrombi at the placental site, disintegrating them.[1]

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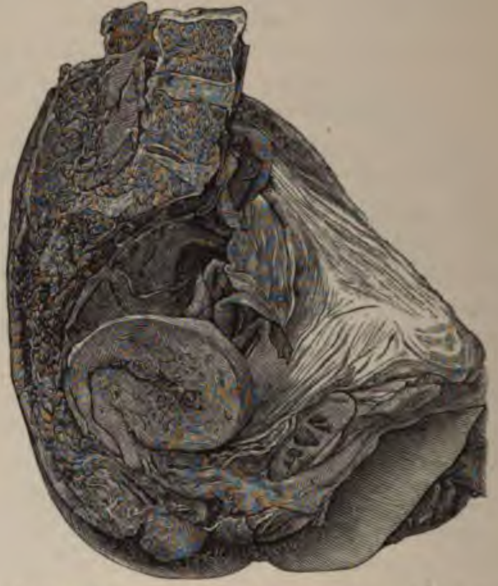
[1] Five interesting cases of puerperal hemorrhage due to uterine displacement are reported by Gräfe in *Ztsch. f. Geburtsh.*, xii. 328.

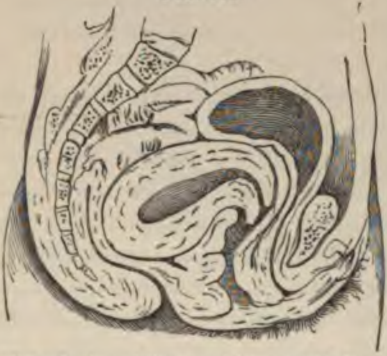
The causes of flexions in the puerperal state are the increased weight of the puerperal uterus with a loss of tonicity. They are therefore not infrequently associated with subinvolution. Backward displacements are most frequently the result of some sudden physical effort soon after leaving the bed, especially if the woman has risen too early, before involution has sufficiently far advanced. Another common cause is the faulty application of a compress under the binder. Many nurses will, unless they are properly directed, place a thick compress in direct relation with the anterior uterine wall, thus crowding the whole organ backward, instead of adjusting it over the fundus of the uterus, where it will maintain a condition of anteversion, and by constant pressure promote firm contraction and rapid involution. Retroversion and retroflexion may persist after premature delivery if these displacements existed during pregnancy.[1] Neglect

FIG. 118.



Frozen Section of Puerperal Uterus in a State of Anteflexion (Stratz).

FIG. 119.



Retroflexion of Puerperal Uterus (Schatz).

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[1] Schatz: *Arch. f. Gynäk.*, Bd. i.

to empty the bladder at proper intervals may be found a cause in some cases. In extreme examples of this kind the uterus is pushed far upward, backward, and usually to the right side.

DIAGNOSIS.—This is easy if a careful physical exploration is made; and it should be an invariable rule to make a vaginal examination in every case of puerperal hemorrhage. It is not rare to find some portion of the ovum or blood-clots retained within the uterine cavity in consequence of the "stenosis by angulation" of the cervical canal.[1] It is therefore not sufficient to rest satisfied with the diagnosis of displacement in puerperal hemorrhage, but it is necessary to be sure there is nothing detained within the uterus. It should be remembered that there may be not hemorrhage, but, for a time, suppression of the lochia with displacements of the uterus. Occasionally the dislocation may occur rather acutely and be associated with grave symptoms, as intense pain and a condition verging on shock.

TREATMENT.—The treatment of puerperal hemorrhages due to a displaced uterus is the rectification of the displacement. This will occasionally be followed by the expulsion of blood-clots or remains of the ovum, which, imprisoned within the uterus, were the true causes of the bleeding.[2] The uterus, restored to its natural position, should be retained there, for a while at least, by some mechanical support.

DISLODGMENT AND DISINTEGRATION OF CLOTS AT THE PLACENTAL SITE.

The thrombus formation in the large sinuses at the placental site plays a very important part in the prevention of hemorrhage after delivery. In consequence of sudden exertion, sitting upright in bed, or actually standing on the floor soon after labor, some of these clots, plugging up important vessels, might be dislodged. It is with this possibility in mind that every precaution should be taken to secure repose and quiet after labor. Fordyce Barker's advice on this point, as on others in obstetrics, is most excellent: If it is necessary that the patient should be raised for any purpose to a sitting posture in bed, the nurse is directed to exert constant firm pressure over the fundus, and to readjust the binder when the patient again lies down. For some time afterward a careful watch is kept for bleeding. Disintegration of the clots at the placental site occurs occasionally in consequence of their invasion by the microbes of animal putrefaction; this is, therefore, one of the phenomena of puerperal infection. The bleeding that follows is "of all puerperal hemorrhages by far the most dangerous" (Schroeder).

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[1] Fernley: *Brit. Med. Journ.*, 1888, ii. 739.

[2] Strachan reports an interesting case of the kind associated with anteflexion. Six weeks after labor there was a severe hemorrhage; the uterus was straightened by upward pressure through the anterior vaginal vault; the following day a cotyledon of the placenta was discharged (*Br. Med. J.*, 1886, i. 587).

DIAGNOSIS.—The hemorrhage that follows displacement of thrombi at the placental site is startling in its suddenness, alarming in the amount of blood lost. There need be nothing in the uterine cavity to account for it; the uterus may be in good position. The true condition can of course only be inferred.

TREATMENT.—The best plan in this form of hemorrhage would be to adopt Dührssen's mode of treatment. It is thus described by its author:[1] He takes with him to every case of labor a strip of 20 per cent. iodoform gauze 3m. long, two handsbreadth in width, in four layers. On this is scattered loose iodoform powder. To tampon the uterus the anterior lip of the cervix is seized as high up as possible with two bullet-forceps; the strip of gauze is then caught by the end in a long pair of forceps and introduced within the uterus. As soon as the point of the forceps enters the uterine cavity the left hand grasps the fundus, and only then is the forceps pushed in as far as it will go. The forceps is then loosened, withdrawn a little, a lower portion of the gauze strip seized, and so the uterus is filled with the gauze lying in fan-shaped folds. "It is astonishing," says Dührssen, "how soon the uterine cavity is filled." The uterus is stimulated to contraction, so one gets the combined advantage of a tampon and a uterine stimulant. When the gauze is removed it has very few blood-clots in it, and has not a trace of putrid odor. Dührssen proposes his method for use in post-partum hemorrhages due to inertia. He makes the confident assertion that whoever employs this plan will never lose a patient from hemorrhage due to *atonia uteri*.

EMOTIONAL CAUSES.—Sudden emotion of any kind will arrest uterine contraction during labor and in the puerperal state. In the latter condition the usual result is a hemorrhage which may be alarming in quantity. Barker[2] gives a most interesting example: a healthy young primipara almost bled to death in the second twenty-four hours after labor in consequence of the brutal conduct of her husband, who was disgusted that his child was a girl. I have seen a sudden and profuse hemorrhage on the seventh day, the result of fright; the patient's stepson returned late at night in a violent state of intoxication.

RELAXATION OF THE UTERUS.

This is a rare cause of hemorrhage after the first twenty-four hours. Barker asserts that he has never met with it later than the third day, and that when it occurs after the first twenty-four hours it is in women of depressed mental and physical condition, exhausted by prolonged labor, weak from insufficient food or bad hygienic surroundings. It is to be treated on the same general principles as primary post-partum hemorrhage from the same cause.

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[1] "Die Uterus-tamponade, mit Iodoform-gaze bei Atonie des Uterus nach normaler Geburt.," *Centrbl. f. Gynäk.*, 1887, xi. 553.

[2] *The Puerperal Diseases*, p. 15.

Retention of Blood-clots.

This is usually the result of uterine relaxation, uterine displacements, or a retention of portions of the ovum, around which the clot is formed. If these conditions are promptly treated, the retention of blood-clots will be prevented. The effect of a clot of any size retained *in utero* is often hemorrhage, possibly septicæmia. It is of course to be removed as soon as the symptoms lead the medical attendant to suspect the presence of a foreign body within the uterus.

Fibroids.

If the puerperal state is complicated by intramural or submucous fibroids of the uterus, there will be certainly a prolongation and increase in amount of the bloody lochia, possibly a serious hemorrhage. The latter is peculiarly liable to happen if the tumor assume the shape of an intra-uterine polyp. Barker[1] gives four interesting cases of the kind. The diagnosis is only to be made by a careful physical exploration. The best treatment is the removal of the growth by scissors after ligature of the base or with the wire écraseur. In case this treatment cannot be carried out, and in other forms of fibroid tumors in the puerperal state, ergot with quinine and strychnine, and the daily application of the faradic current, will do much to secure firm uterine contraction and prevent hemorrhage.

Hæmatomata.

Blood-tumors along the genital tract may burst during the puerperal state, with most serious external hemorrhage. This matter will be referred to later.

Pelvic Engorgement.

Congestion of the pelvic blood-vessels may lead to puerperal hemorrhage. The congestion may be due to heart, kidney, or liver disease; to increased intra-abdominal pressure from any cause; to the determination of blood toward internal organs during a chill;[2] to premature sexual intercourse; to the erethism following the return of the husband to the wife's bed; to inflammations about the uterus; to subinvolution from any cause; to ovarian irritation (Barnes); to constipation. Mauriceau[1] describes a case of puerperal hemorrhage that continued quite profusely for five or six days, and which was only stopped when "a pretty strong clyster" resulted in the evacuation of "a panful of gross excrements."

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[1] *Loc. cit.*

[2] Winckel (*Path. u. Therap. des Wochenb.*) reports 4 cases of this kind out of 114 of puerperal hemorrhage. I once met with a striking example during a malarial attack some days after labor.

Wounds in the Genital Tract.

Secondary hemorrhage may occur from wounds in the cervix, vagina, and vulva. Occasionally, abnormally large blood-vessels are injured in these regions: on one occasion I saw a hemorrhage from an anomalous artery in the perineum that nearly proved fatal. A medical student who had charge of the case stood idly by while the blood spurted out from the lacerated perineum in large jets: when I arrived the woman was pulseless and intensely anæmic; she subsequently died from septic infection. It is possible that a vessel of considerable size might be wounded during labor, and yet, in consequence of pressure from the child's head or of an unstable plug of clotted blood, would not bleed until, at some time in the puerperal state, the tissues recovering their tone or the clot being dislodged, hemorrhage would occur. Barker describes a case of this sort in which there was on the second day arterial hemorrhage from one labium.

The DIAGNOSIS is easily made if the parts are exposed to view. The bleeding vessel may be detected and should be ligatured.

Carcinoma of Corpus and Cervix.

Carcinoma has been known to develop at the placental site during childbed. Chiari[2] reports three cases in a single year of carcinoma at the placental site ending fatally within six months after labor. Delivery had in each instance been spontaneous: repeated hemorrhages had occurred during the puerperal state. Kucher[3] reports a case in which death followed much earlier than in the above instances. The patient, seen fourteen days after spontaneous delivery, was suffering from repeated hemorrhages. A few weeks afterward she died; the post-mortem examination revealed carcinoma of the corpus uteri. Epithelioma of the cervix, if at all advanced, must surely, among other disastrous consequences, entail a danger of hemorrhage. The diagnosis of corporeal cancer would be practically impossible during life. The only reliable treatment of hemorrhage from this cause would be a uterine tampon after the method of Dührssen. A vaginal tampon would control the bleeding from a carcinomatous cervix.

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[1] *Diseases of Women with Child and in Childbed*, tr. by Hugh Chamberlen, London, 1752.

[2] *Med. Jahrb.*, iii. 887.

[3] *Puerperal Convalescence and Diseases of the Puerperal Period*, New York, 1886, p. 79.

As rare causes of puerperal hemorrhage might be mentioned rupture of the uterine artery, as occurred in a case reported by Hewitt,[1] with a fatal result six weeks after labor; the rupture of a distended vein in the cervix, followed by fatal bleeding, as happened in a case described by Hecker.[2] Meschek[3] reports a similar case, with like result, due to an eroding ulcer which opened a large vessel in the cervix. Johnston tells of a fatal puerperal hemorrhage due to rupture of a hæmatoma of the cervix.[4]

PUERPERAL HÆMATOMA.

A form of hemorrhage in the female genitalia during or after labor, much more rare than the secondary hemorrhages just described, is an interstitial effusion of blood, with the consequent formation of a blood-tumor varying in size with the degree of the hemorrhage. Levret seems to have been familiar with this accident, but with this exception a knowledge of the nature of hæmatomata in puerperæ is confined to quite recent times. The first systematic treatise on the subject is Deneux's monograph.[5] It was also fully described by Dewees,[6] professor of obstetrics in the University of Pennsylvania. Of late years the literature relating to this complication of the puerperal state has become quite extensive, and much has been accomplished in adding to the knowledge of the subject, especially as regards prognosis and treatment. In this country Fordyce Barker is justly regarded as the ablest and clearest exponent of the best therapeutic measures to adopt. The accident, as has been stated, is of rare occurrence, but individual experience differs widely as to its frequency. Deneux was able to collect 62 cases, but had himself only seen 3 in a practice of fourteen years. Paul Dubois saw but 1 case out of 14,000 labors. Velpeau,[7] writing five years after the appearance of Deneux's article, declared it would be easy to collect the detailed accounts of 100 cases—that he himself had seen 25. Barker of New York reports 22 cases that came under his personal observation. Winckel quotes Clintock's claim that he had observed 25 cases, and places an exclamation-mark after the quotation, evidently as a sign of incredulity.[8] The former has only met with 6 well-marked cases in an experience of almost 20,000 confinements. Bossi found hæmatoma twice among 5660 women in child-bed; Hugenberger, 11 times in 14,000 deliveries; in Vienna it was noted 18 times out of 33,241 births.[1] This would indicate a fr[illegible] frequency of 1 to 1600 births.

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[1] *London Obstet. Trans.*, vol. ix.

[2] *M. f. G.*, Bd. vii. S. 2.

[3] *Ztschr. d. Ges. d. Wien. Aerzte*, 1854, x.

[4] Sinclair: *Pract. of Midwifery*, 1858, p. 501.

[5] *Tumeurs sanguines de la Vulve et du Vagin*, Paris, 1830.

[6] *Diseases of Females.*

[7] *Traité complèt de l'Art des Accouchmens*, Brussels, 1835.

[8] *Lehrbuch der Geburtshülfe*, 1889.

SITUATION.—This is most frequently, by far, in one or the other labium majus, rarely in both. The blood-tumor may, however, occupy a position beneath the vaginal wall, to either side, or posteriorly and anteriorly in the labia minora; in the caruncula myrtiformes; under the skin of the perineum, between the superficial and median fascia; [illegible]; in the cervix; in the periuterine connective tissue; within the broad ligament; in the subperitoneal connective tissue, on the posterior and anterior abdominal walls, extending as high as the kidneys and navel (Cazeux, Hugenberger, Winckel); under the skin of the mons Veneris or over the inguinal ring (Velpeau). If the effusion occur above the pelvic fascia, the blood is apt to force its way upward toward the diaphragm; if below, downward toward the vulva.

SIZE AND FORM.—Barnes[2] says that post-mortem examinations have convinced him that small extravasations of blood are to be met with along the genital tract universally after labor: this diffuse thrombus is due to the fact that the mucous membrane is pushed in front of the presenting part with a glacier-like movement over the underlying tissues, and there thus occurs a rupture to some degree of the submucous connective tissue and the small blood-vessels contained in it. Winckel has seen numerous hæmatomata after labor, varying in size from that of a pigeon's egg to that of a walnut. It is the larger tumors that are more rare. They may vary in size from that of a hen's egg to that of a child's head; in extreme cases, where the blood is diffused throughout a great part of the subperitoneal connective tissue, the size would be very large were the blood contained within a limited circumscribed tumor.

In shape these blood-tumors of the genital tract are most often globular; in the cervix they distend the tissues of one or both lips downward and outward, assuming somewhat the form of a shark's nose. In the vagina they may hang from the anterior or posterior wall in the form of a polyp (Fleischmann).

ETIOLOGY.—The predisposing causes of puerperal hæmatoma are the engorged condition of the blood-vessels along the genital tract, and the strain that is imposed upon them either by the pressure of the fœtal mass or the great muscular effort put forth during labor. The more engorged the vessels are, the likelier is the occurrence of hæmatoma. Winckel says it is self-evident that varicose veins predispose to this accident. Barker, however, denies this emphatically. It is certainly true that many a case of varicose veins may be met with before a hæmatoma is seen, and in many instances of the latter the veins were in no wise affected. Halliday Croom,[1] attaches great importance to anteversion of the parturient uterus as a predisposing cause of vaginal hæmatoma, believing that thus an excessive strain is put upon the whole posterior vaginal wall, and a rupture of distended blood-vessels in this region rendered more probable. This explanation seems reasonable, but it leaves unexplained the hæmatomata in other situations along the birth-canal. Hypertrophic elongation of the cervix certainly predisposes to the formation of hæmatomata in that region during and after labor. The determining cause of this accident may occasionally be found in direct injury to the tissues by forceps, and rarely by a fall or a blow, or it might be explained by violent straining efforts during the second stage of labor. In the majority of cases, however (86 per cent. Winckel), the occurrence of these blood-tumors will be apparently spontaneous. The immediate cause of the hæmatoma is the rupture of a blood-vessel and the insterstitial extravasation of blood ; the vessel injured is commonly a vein, not rarely of large size. Possibly, a number of smaller vessels may be ruptured. The injury to the blood-vessels is either a direct and immediate laceration, or else later a perforation by pressure necrosis.

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[1] These latter statistics are taken from Winckel's book, where a reference to the original authorities may be found.

[2] *System of Obstetric Medicine and Surgery.*

Clinical History and Diagnosis.—The interstitial hemorrhage that results in a hæmatoma begins, with rare exceptions, during labor: it may at first be quite gradual, so that it does not attract attention until some time in the puerperal state. The distension of the vagina by the presenting part of the fœtus may prevent all bleeding until the maternal tissues are relieved of pressure and regain to some extent their natural tone. Or if the bleeding results from necrosis of tissue, the result of prolonged pressure, the formation of a hæmatoma may first begin after delivery. In cases where this has seemed to be the result of violent coughing or other exertion during the childbed period, there had been no doubt some injury done the vessels during the process of parturition. The subcutaneous or submucous laceration of tissue occurring, as a rule, during the second stage of labor, is almost always associated with great pain of a sharp, lancinating character quite different from labor-pains. The suffering increases as the hæmatoma grows in size, and in addition to the sharp pain of torn tissue there is developed exaggerated and painful expulsive action on the part of the uterus, excited by the presence of the tumor within the vagina. This is a symptom almost constant, but Barker tells of a painless case, and says that his is not the only one recorded. The hemorrhage into the tissues may be profuse enough to occasion the most marked signs of acute anæmia. Pallor of the countenance, failure of vision, a thready pulse, that sound between a gape and a sigh, loss of consciousness, and finally death, may all be noted without the slightest external escape of blood. An examination of the patient will reveal a tumor occupying the situations already described, of varying size, and differing in consistency as the blood contained in it is fluid or clotted; if the hæmatoma is submucous, it presents a dark purplish color like clotted blood; if it is covered with skin, it presents a bluish, ecchymotic hue. As a rule, the swelling only appears after labor; it may, however, occur before the expulsion of the child, and it has repeatedly developed between the birth of twins.[1] If the tumor is formed during labor, it may present a formidable obstacle to delivery; if it appears in the puerperal state, it may dam back the lochia or give rise to ischuria or retention of feces. With the history of a sharp attack of pain during labor the subsequent rapid development of a tumor along the genital tract characteristic in its appearance and situation, the signs of internal hemorrhage, the diagnosis of the true condition ought not to be difficult; and yet a mistake is quite possible. Winckel says that puerperal hæmatoma has been confused with varicose tumors of the labia, inguinal hernia, and inversion of the vagina. Once in Barker's experience a vaginal hæmatoma was mistaken for a fœtal head, and once for placenta prævia. Auvard[2] says that on first sight he took a hæmatoma of the anterior lip of the cervix for a clot of blood lying in the vagina; the Barneses,[3] in describing their case of cervical hæmatoma, write that they found a fleshy tumor projecting from the vulva which looked like a mass of coagulated blood or which might have been mistaken for an inverted uterus. The diagnosis would, it seems, be more difficult in cervical hæmatomata than in those lower down in the genital canal. Luckily, the former are rare. Besides the two just mentioned, others are described by Hohl, Braun, Earle (2 cases) and Winckel.[4] Hæmatomata along the genital canal may burst soon after their formation, with appalling hemorrhage which may rapidly prove fatal. In cases of labial tumors the point of rupture is likely to be the boundary-line between the greater and lesser labia (Winckel). A hæmatoma within the pelvis may open into the peritoneal cavity with fatal hemorrhage. After early rupture or primary incision of the tumor the hemorrhage will almost surely be great, and there is apt to occur secondary bleeding. This does not happen, as a rule, when the tumor is opened after bleeding into it has ceased.

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[1] "On the Etiology of Vaginal Hæmatoma occurring during Labor," *Edin. Med. Journ.*, vol. xxxi. pt. 2, p. 1001.

Winckel thus summarizes the termination of puerperal hæmatoma: (1) Death by hemorrhage with or without previous rupture of the tumor;

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[1] One case reported by Dewees (*Diseases of Females*, "Of Bloody Infiltration in the Labia Pudendi") and six by Madame Sasanoff (*Annales de Gynécologie*, December, 1884). Four of these latter cases died.

[2] *Trav. Obstet.*, Paris, 1889, t. i. p. 449.

[3] *System of Obstetric Med. and Surg.*, Philadelphia, 1885.

[4] *Lehrbuch*, 18[illegible].

(2) death following suppuration of the sac and septicæmia, most frequently after the sac has been opened; (3) rupture of the tumor, with recovery; (4) rupture of the tumor, with a resulting fistula; (5) perfect recovery by absorption of the effused blood, without rupture of the sac. In 50 cases collected by Winckel from modern literature the tumor burst spontaneously within the first eight days in 23. A hæmatoma may be evacuated not only by escape of the contained blood externally, but by diffusion of its contents under the skin. Dill[1] reports a case of large hæmatoma of the right labium which burst, and at the same time occasioned ecchymoses reaching to the nates and the right knee, to the umbilicus, and even as high as the right axilla. Suppuration may occur in a blood-tumor that has not been ruptured at all, and the effused blood may be converted into a large collection of pus. As these abscesses are often in the neighborhood of the rectum, the pus often acquires a fecal odor, even without a communication with the bowel. There can, however, result a recto-vaginal fistula if the hæmatoma breaks its way into the rectum and bursts or is opened anteriorly into the vagina. More commonly the fistulæ following hæmatomata open from the vagina upon the perineum. Fistulæ follow hæmatomata in 4 per cent. of all cases (Winckel). Suppuration is most to be feared after the blood-tumor is opened and its cavity exposed to the germs of the atmosphere as well as to those contained in the lochia. The contents of the tumor offer a most suitable nidus for the growth of pathogenic micro-organisms, and the large absorbing surface of the tumor-wall gives ready access to the system for microbes and the products of their activity.

Prognosis.—The formation of a hæmatoma during or after labor was formerly regarded as a more dangerous complication than it is considered to-day. Of Deneux's 62 cases, 22 died. Fatal cases have been reported by Cazeaux, Lubanski, Broers, Seulen, Josenhans, Hugenberger (4), and Braun (Winckel). The causes of death in these cases were hemorrhage (in one instance into the peritoneal cavity), septicæmia, and typhoid fever. Blot collected 19 cases since Deneux's paper was published, with 5 deaths. Perret, in an analysis of 43 cases, found 17 deaths. Of 11 cases observed by Hugenberger,[2] 4 died. Girard,[3] from an analysis of 120 cases, found 24 deaths. Johnston and Sinclair[4] report 7 cases during seven years' service in the Dublin Rotunda, with 2 deaths. Scanzoni met with 15 cases, 1 of which died. Winckel, among 50 cases, found only 6 deaths. Of the 6 cases in his personal experience, not one died. Barker reports 22 cases of his own—13 in hospital, 9 in private practice; among the former, 2 died. Barnes[1] reports 2 cases with favorable issue; Auvard,[2] 1 of cervical hæmatoma that disappeared by absorption. Croom's 3 cases all recovered. Now that the nature of the accident is well understood, that the means of checking hemorrhage and preserving an aseptic condition about the wounded part are much improved, death from puerperal hæmatoma should be rare, especially if the patient's general condition is good and her hygienic surroundings satisfactory.

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[1] *Dublin Journ. Med. Sci.*, Nov., 1886.

[2] *St. Petersb. Med. Zeitung*, 1865.

[3] "Contribution à l'Étude des Thrombes de la Vulve et du Vagin dans leurs Rapports avec la Grossesse et l'Accouchement," *Thèse de Paris*, 1874.

[4] Barker: *loc. cit.*

TREATMENT.—If the hæmatoma is of moderate size, not larger than one's fist, the main object of treatment is to secure absorption of the effused blood, and thus the disappearance of the tumor. This is by far the most favorable issue of these tumors, for when it is possible the women run no risk of septicæmia and hemorrhage, the two chief dangers associated with puerperal hæmatomata. It may, however, be necessary to remove an obstruction to labor when one of these tumors develops before delivery; to control the hemorrhage either before or after rupture of the sac; to treat the general symptoms of profuse bleeding; to evacuate the contents of the sac when suppuration has occurred; and to prevent septic infection.

To secure the disappearance of a hæmatoma by absorption cleanliness of the parts and rest are to be secured. If the tumor is vaginal or cervical, frequent antiseptic injections would be advisable; if the effusion is subcutaneous, cooling lotions and inunctions with oil or cosmoline will often prevent inflammation and rupture of the sac. If the tumor appears before or during labor, and offers an obstacle to the delivery of the child, it must be freely opened; the contents, whether fluid or clotted blood, evacuated; pressure exerted by the hand of an assistant, aided perhaps by a tampon of iodoform gauze, in order to check the hemorrhage; while the extraction of the infant by the forceps or after version is hastened as much as possible. To control the hemorrhage into the tissues before external rupture has occurred, pressure, cold, and the internal administration of ergot may be tried. An ordinary tampon in the vagina is not admissible, for it would dam back the lochial secretion, would become, moreover, saturated with it, and favor decomposition of the putrescible discharges caught in its meshes. Braun's colpeurynter, distended with ice-water, will answer the purpose better, for it can be easily removed at frequent intervals to allow an antiseptic irrigation of the vagina. It is well not to open the tumor while it is increasing in size, for there may be profuse hemorrhage at the time, and a secondary bleeding later. This does not occur, as a rule, when the tumor is incised after the effusion ceases, and yet there are two cases on record in which hemorrhage occurred from tumors opened one and three weeks after their formation.[3] If the tumors are too large to be absorbed, or if there is threatened gangrene of their coverings, they should be opened.

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[1] *Loc. cit.*

[2] *Loc. cit.*

[3] Parvin's *Obstetrics*, p. 502.

Many hæmatomata burst within the first few days after their formation: there may be, in consequence of the rupture, an alarming hemorrhage. In such cases it is best to enlarge the opening, turn out the clots within the tumor, search for the bleeding vessel or vessels, which may be seen spurting from the walls, and apply a ligature. If this is impossible and bleeding still continues, the cavity may be firmly packed with iodoform gauze, firm external pressure being exerted by a pad of antiseptic wool and a bandage. It is better, if it can be avoided, not to use the styptic salts of iron, for such a firm, dense clot is thus formed that it takes a long time for it to disintegrate, the woman meanwhile running a risk of septicæmia.

After the coverings of a hæmatoma are incised or ruptured, suppuration will commonly occur in the cavity; septicæmia must be avoided in such cases either by an antiseptic tampon in the abscess-cavity often renewed, or else frequently-repeated antiseptic injections. Suppuration may occur before the tumor has been opened at all. In such cases the pus must be evacuated. The opening should not be delayed too long, especially in suppurating hæmatomata of the posterior vaginal wall, or fistulæ may result. The general treatment for loss of blood is to be conducted in the ordinary manner when the indications call for it—hypodermics of ether, brandy, and hot animal broths internally; copious draughts of hot water, "auto-infusion" by bandaging the limbs; and possibly actual intravenous infusion of a weak saline solution.

NON-INFECTIOUS FEVERS.

Fever in the puerperal state not due to infection may arise from emotional causes, from exposure to cold, from constipation, from reflex irritation of any kind, from cerebral disease, from eclampsia, from insolation, from syphilis, from the exacerbation or persistence of an acute or chronic disease contracted during or before pregnancy. The limitation of the heading under which these affections are grouped excludes all consideration of septic infection and of the infectious fevers, as the exanthemata, erysipelas, typhoid fever, malaria, pneumonia, which will be dealt with in another place.

Emotional Fever.—With the modern view of fever—that there must be a disturbance in the nerve-centres which govern heat-dissipation, heat-production, and the relations between them[1]—there is nothing at all incompatible in classifying certain elevations of temperature as purely nervous in origin; that is, with no lesion of thermic centres, no irritation of them by foreign matters in the blood, but simply a nervous stimulation or a disturbance of balance in the heat-controlling regions, occasioned by some profound psychical impression, as grief, anger, fear. Admitting,[1] as one must, that, after direct injury, stimulation or disease of certain regions in the brain or spinal cord, fever will surely develop,[2] it is easy to go one step farther and assume that the normal action of these centres may be disturbed by some powerful emotion which profoundly affects the higher cerebral functions.

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[1] Welch: "Cartwright Lectures on the Pathology of Fevers," *Medical News*, 1888, 365 *et seq.*

Another theory of fever after emotions deserves at least some consideration. It is possible that the mental action produces a change in the composition of the blood or of the fluids in glands and muscles which, it is well known, take a part in heat-production. It is possible that thus a thermogenic leucomaïne is manufactured.

There are some who would perhaps look to the vaso-motor nerves for an explanation of emotional fever, expecting excitation or paralysis as they are followers of Traube or Marey.

That fever may appear in consequence of emotions, clinical evidence leaves no doubt. The explanation of its occurrence is of minor importance in comparison with a knowledge of the fact, for a comprehension of the former will not be required to treat such cases properly, if, indeed, they demand treatment at all: the cause of the fever being transient, perhaps momentary, the elevated temperature quickly sinks to normal. It is not in every person that powerful emotion will be followed by an elevation of temperature to a noteworthy degree. There must apparently be predisposing causes in the nervous system of the individual. Emotional fever is not seen in men with well-poised minds used to the vicissitudes of life, opposing a resisting front to external impressions. It is most often met with in children, in hysterical girls,[3] and in women after childbirth. In these conditions, childhood hysteria, and childbed, there is a curious irritability of the organism, a lack of control over the mental processes. The petulant child, easily swayed by and completely yielding to emotions, subject on slight provocation to convulsions, is a familiar picture; and no one can overlook this same mental and nervous character in pregnancy and the early part of the puerperal state. It is this condition of the nervous system, apparently, that predisposes to emotional fever. Some time ago I had under my care in the infant asylum of the Philadelphia Hospital a young child who was frequently thrown from slight cause into violent fits of anger. Immediately after these paroxysms the temperature would be raised, sometimes to 103°. Within an hour the fever disappeared.

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[1] White: *Guy's Hospital Reports*, 1884, p. 49, "The Theory of a Heat-centre from a Clinical Point of View."

[2] Welch quotes the case reported by Sir Benjamin Brodie, in which an injury to the spinal cord in the cervical region was followed by a temperature of 111° Fahr. The fact that puncture with a fine needle of the anterior part of the caudate nucleus is followed by a rise of temperature to three degrees or more is also verified by this author. It is claimed that there are three other heat-controlling regions in the brain.

[3] The case reported by Dr. Mahomed is a famous example: the temperature is said to have reached 128° Fahr. (*Lancet*, 1881, vol. ii. p. 790).

Lawson Tait read before the London Obstetrical Society a paper entitled "Some Observations on Puerperal Temperatures," based on records of 125 cases in which the temperature was taken every four hours: almost all of them had fever, and in quite a large number it was attributed to nervous origin. The number is doubtless over-estimated, for emotional fever in the puerperal state is not so frequently seen as these statistics would lead one to suppose. Hunt's[1] records of 75 cases, confined to women free from infection and inflammation, in which the temperature was taken twice a day in the mouth, gives three apparently typical examples of fever from emotion. In one the cause is put down as "acute domestic infelicity;" in another, as ill-usage; and in the third, as anxiety. In the Maternity Hospital, designed for the reception of young girls illegitimately pregnant for the first time, I have seen many examples of emotional fevers. Failure to receive an expected letter, fear of exposure, the expected removal of the infant to an asylum, and dread of an operation for mammary abscess, have all been discovered as causes of the marked mental disturbance that produces

FIG. 120.

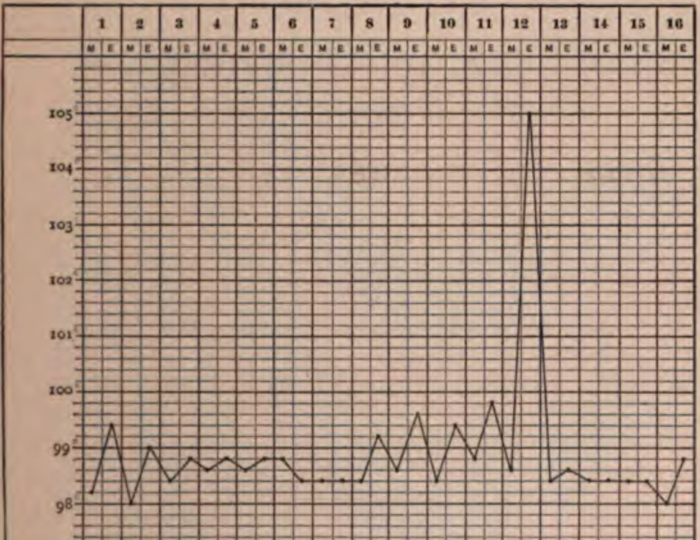

Chart of Emotional Fever from Dread of an Operation.

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[1] "Normal Course of Puerperal Temperature," *Practitioner*, London, 1888, p. 81.

fever. The last-mentioned cause furnished perhaps the most typical case. There had been in the ward one operation for suppuration in the breast; it was witnessed by two puerperal patients. One of these, a young girl, shortly after experienced pain in the breast; she at once conceived a morbid dread of an operation. The beginning elevation of temperature in the chart indicates the commencement of engorgement and pain in the breast. This went on for a few days, when, after having lain awake all night brooding on the subject, the girl's temperature began to rise in the morning, finally reaching the height indicated on the chart. The most effective antipyretic employed was the emphatic assurance of the resident physician that there was not, and would not be, the slightest excuse for an incision of the breast. The patient's fears being calmed, her temperature quickly sank to normal, where it remained.

FEVER FROM EXPOSURE TO COLD.

In the sensitive condition of puerperæ it is not uncommon to see a febrile reaction follow undue exposure. A careless nurse or attendant may be responsible for too low a temperature in the lying-in

FIG. 121.

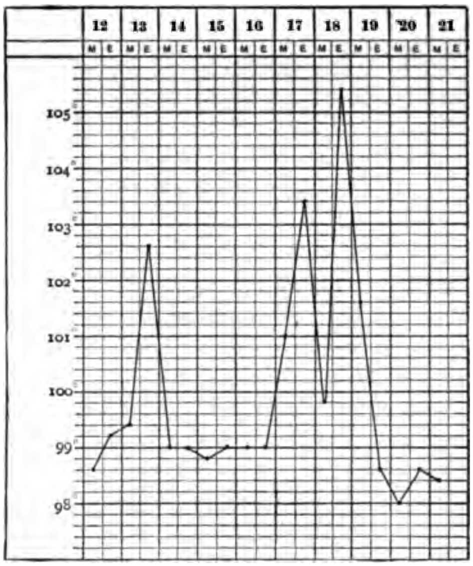

Chart of Fever Case from Exposure to Cold.

room, or for ill-regulated ventilation, or for insufficient or ill-arranged bed-clothing. A wilful patient may leave her bed too soon and expose herself, thinly clad, to cold. I have seen a good illustrative case in the Maternity Hospital: it occurred in midwinter. Kate B——, a private patient, left her bed on the twelfth day after labor, without permission and very imperfectly dressed: some disturbance in the street attracted her to the window, where she stood quite a long time looking out. On the following day she had fever; she was kept in bed for four days, and on arising was again imprudent about her apparel. The fever returned with sharp pain in the abdomen, which was relieved by turpentine stupes. There was no infiltration to either side of the uterus, no evidence of infection. Finally, with greater care for body-warmth, the woman left her bed and was troubled no more.

CONSTIPATION.

Schroeder[1] says that "among the causes, aside from infection and local inflammations, which, with special frequency, produce fever in the puerperal state, over-distension of the intestines with fecal masses should be given a foremost place." This statement of an eminent authority assigns too important a rôle, I think, to constipation among the causes of elevated temperature after delivery. Every practitioner of obstetrics, however, has doubtless seen an example of this sort of puerperal fever.

FIG. 122.

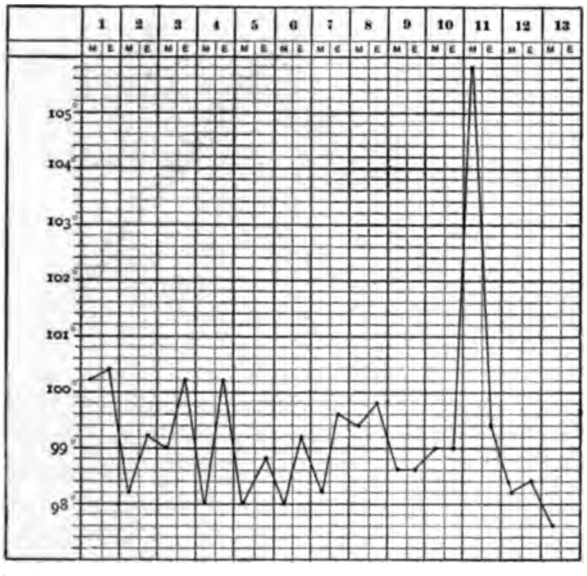

Chart of a Woman constipated for six days in the latter part of the Puerperal State.

The temperature chart (Fig. 122) is from a woman in the Philadelphia Hospital who had had but one evacuation of the bowels—on the fifth day—in the eleven days succeeding delivery. The temperature rose to a great height, but fell almost immediately after the administration of an enema containing an ounce each of glycerin and hot water.

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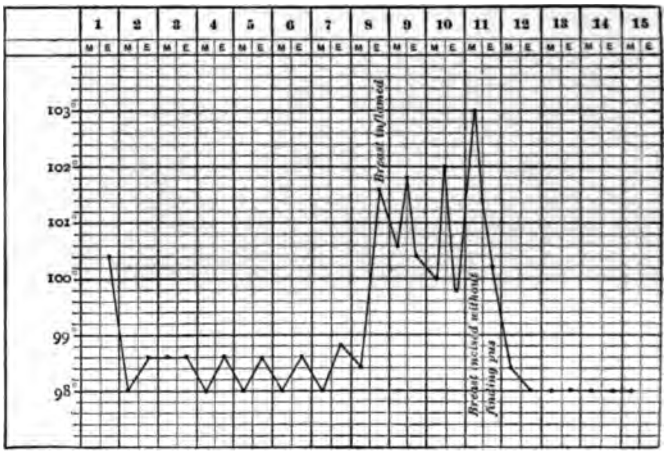
[1] *Lehrbuch*, 8te Aufl. S. 803.

FEVER FROM REFLEX IRRITATION.

Physical irritation, as well as psychical, is often reflected in general elevation of the body-temperature during the puerperal state. The irritating point is most often to be found in the breast. It is quite true that "milk fever" as a constant occurrence in the puerperal state should no longer be looked for since the advent of antisepsis. But, nevertheless, there may be found in women of sensitive nervous organism a well-marked fever which can be traced to no other cause than the engorgement and distension of the breast. The appended temperature chart (Fig. 123) well illustrates this point. A young primipara developed on the eighth day of the puerperal state apparently an acute mastitis. The pain, the redness of the skin, the swelling of the breast, and the course of the temperature, all led me to believe that suppuration had occurred. Consequently, I cut deeply into the gland: there was free bleeding, but not a drop of pus was found. Immediately after the incision, which relieved the engorgement of the breast and the tension of the skin, the temperature began to fall with unbroken descent to normal.

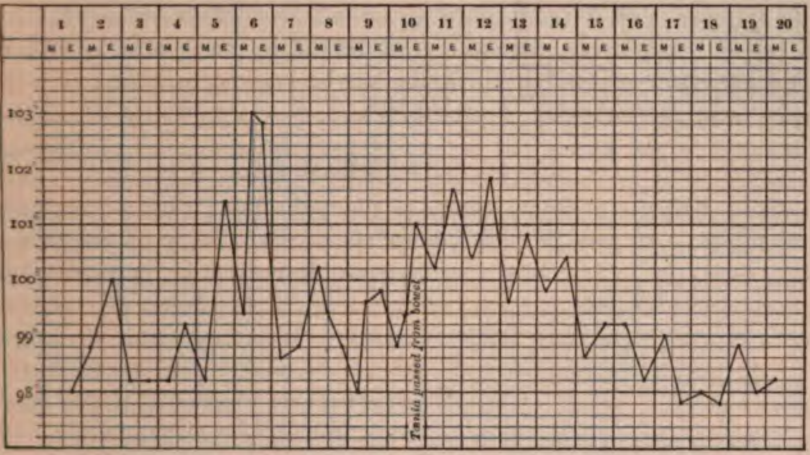
FIG. 123.



Reflex Fever from Mammary Congestion.

The focus of irritation is not always the mammary gland. A year ago I saw a most curious complication of the puerperal state. A rather elderly primipara was delivered without difficulty of a healthy infant. During the early part of the puerperal state the woman began to complain of a constant and distressing headache; diarrhœa came on, which resisted treatment, and the woman's mental state tended rapidly toward pronounced melancholia. With it all, the temperature rose in a suspicious curve. On the ninth day the body of a tapeworm, fourteen and a half feet long, was passed from the bowel, and shortly afterward the temperature dropped to normal.

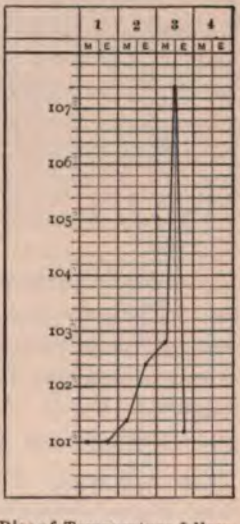
Fig. 124.



Fever followed by Expulsion of Tape-Worm.

It has seemed to me that the great elevation of temperature which often follows perforation into the peritoneal cavity, coming on as it commonly does at once, should also be attributed more to an intense reflex irritation than to septicæmia. The annexed chart (Fig. 125) is from a case under the care of a colleague in the Philadelphia Hospital in which the placenta was abnormally adherent. Separation was accomplished four hours after delivery by means of the fingers and a curette. Ulceration of a limited area in the placental site followed, which ended in perforation and death on the third day.

Fig. 125.



Rise of Temperature following Perforation of the Uterus.

Fever in the Puerperal State from Cerebral Disease.

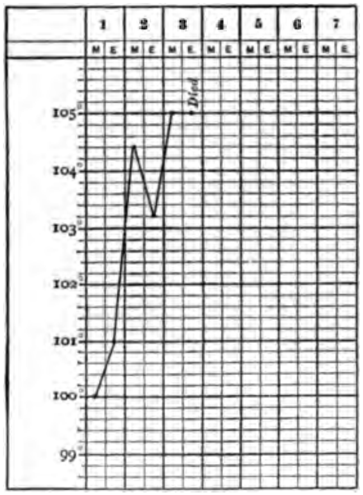
A woman in the puerperal state might have a tumor in brain or spinal cord, insular sclerosis, locomotor ataxia, or degenerative changes in the brain,—all of which could give rise to elevations of temperature.[1] It is, however, to cerebral hemorrhages and embolism that one should usually look for an explanation of fever arising from brain disease, for these accidents are by no means rare during the lying-in; and if the hemorrhage or embolism affects certain regions, a rise of temperature, often to a great height, is pretty sure to follow. A temperature of 108° in the axilla has been noted in a case of cerebral embolism following childbirth.[2]

FEVER WITH ECLAMPSIA.

It is difficult to know where to place the fever that accompanies eclampsia. As very little is known about the etiology of the disease itself, so it cannot be expected that the origin of the fever will be explained. With our present knowledge it is safe to put it among the non-infectious fevers of the puerperal state. Winckel,[3] writing in 1878, said he had observed and had called attention to the fever accompanying eclampsia fifteen years before: he was accordingly the first to refer to it. Bourneville and Budin published this fact as an original discovery in 1872.

With each convulsion there is commonly a notable rise of temperature, until finally the fever may run very high.

FIG. 126.



Fever Chart of Patient who Died of Eclampsia.

INSOLATION.

Sunstroke or heat-stroke is by no means an impossible accident to lying-in women in the torrid temperature of summer in this part of the country. The only case, however, that I know of occurred at sea in a ship sailing from France to New Orleans.[4] The cabin in which the woman was confined was hot and ill-ventilated. The temperature of the air was 93.4° Fahr. A portion of the membranes was left behind, and the discharge was offensive, but there was no fever. On the fourth day, however, the temperature rose to 104°, and shortly after mounted to 109.4° in the rectum. The woman ultimately recovered, in spite of Liebermeister's declaration that death inevitably follows in man when the temperature rises to 108.5°.

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[1] W. Hale White: "The Theory of a Heat-centre, from a Clinical Point of View," *Guy's Hospital Reports*, 1884, p. 49.

[2] Neve: "A Case of Cerebral Embolism, with Hyperpyrexia, following Childbirth," *Lancet*, 1884, ii. p. 103.

[3] *Path. u. Therap. des Wochenbettes*, 3te Aufl., 1878, p. 493.

[4] Skinner: "Sur un Cas d'Hyperthermie post-puerpérale," *Le Progrès médical*, 1887, p. 269.

SYPHILITIC FEVER.

Mewis,[1] from an analysis of 167 cases of syphilis in lying-in women, made in 1879, came to the conclusion that the influence of the puerperal state upon the local lesions of the disease was a favorable one, but he called attention to a special tendency in syphilitic women to specific febrile action and to periuterine inflammations during that period. Fournier's discovery of a specific syphilitic fever naturally turned the attention of French writers and students to this matter, and there were four elaborate theses on the subject written in Paris during the years 1885–86. According to Combes,[2] the idea that syphilitic fever might complicate the puerperal state was first suggested by Pinard to Sacreste, who embodied this notion in a thesis.[3] In this article the assertion is made that of 24 puerperal cases in which syphilis existed, 18 presented the specific fever. The fever is described as moderate, innocuous, lasting seven to eight days. These observations were made in such an astonishingly careless manner, however, that they are quite worthless. Mercier[4] describes 9 cases among syphilitic puerperæ in which there developed fever, irregular, intermittent, or remittent in type, yielding to internal administration of mercury, and not influenced by antiseptic injections. Fauconnier[5] studied the puerperal state of 36 syphilitic women: in 21 there was no fever; in 7 cases there was an elevation of temperature that could be explained by some complication of the puerperal state; in 8 instances nothing could be found to account for the rise of temperature but the syphilitic condition.

Combes[6] made a very careful and accurate investigation of the matter. His material for observation consisted of 188 cases in the services of Drs. Porak and Doléris. Of this number the puerperal state was afebrile in 141. There was fever in 47—a proportion of 33 per cent. Of the latter number, 38 could be explained by the commoner complications of the puerperal state; 9 admitted of no definite explanation except the essential fever of syphilis; but in 2 of these cases infection had occurred more than three years before, and they are therefore excluded. This leaves 7 cases of fever out of 188 confinements in syphilitic women to be attributed to syphilitic fever, and even this small number should perhaps be diminished by the subtraction of 3 more in which the duration of the disease was unknown, and could have been more than three years. Thus the proportion of syphilitic fever to be looked for in women after childbirth is only a trifle over 2 per cent. of those women affected with the disease. This estimate is probably correct. I have never seen a case myself in the puerperal state, but once witnessed a typical example in a child with hereditary syphilis (Fig. 127). In my own experience with syphilitic women in childbed the disease has only interfered with puerperal convalescence in two ways: either by the retention within the uterus of the hypertrophied deciduous membrane,[1] which is so often seen as a result of syphilis, or, as in one instance, by septic infection which occurred in consequence of large ulcerated surfaces in the vagina that had developed during pregnancy.

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[1] *Ztschr. f. Geburtsh. u. Gynäk.*, Bd. iv. H. 1.

[2] "Suites des Couches chez les Syphilitiques," *Thèse de Paris*, 1886.

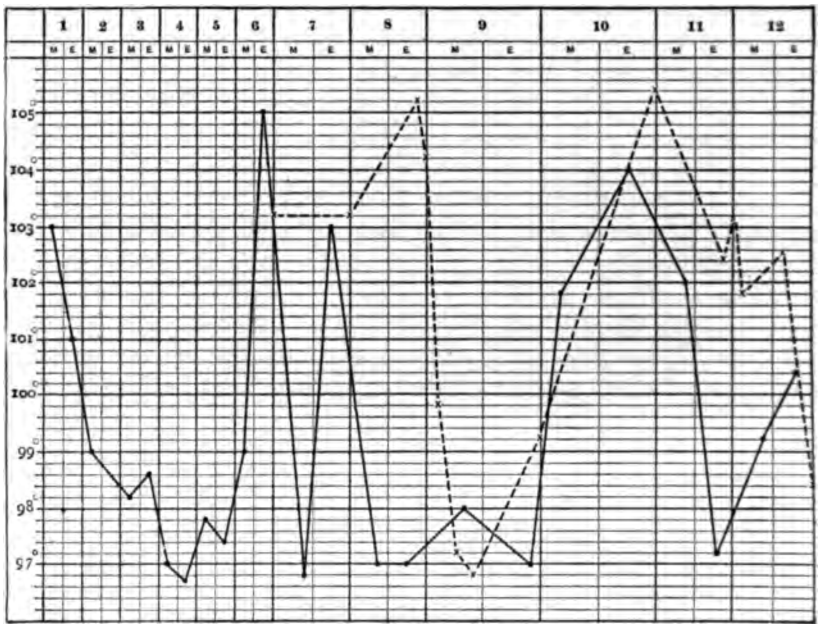
[3] *De l'Hyperthermie syphilitique post-partum*, Paris, 1885.

[4] "Contribution à l'Étude des Rapports de la Puerpéralité et de la Syphilis," *Thèse de Paris*, 1886.

[5] *De la Fièvre et des Metrorrhagies dans les Accouchements syphilitiques.*

[6] *Loc. cit.*

FIG. 127.



Temperature Chart of Child with Syphilitic Fever.

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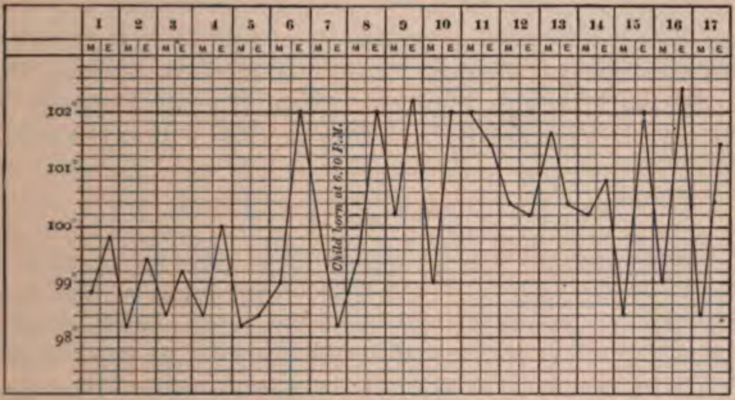
[1] See Kaltenbach on "Syphilitic Endometritis in Pregnancy and the Puerperal State," *Zeitschr. f. Geburts.*, Bd. ii. p. 225.

PERSISTENCE OR EXACERBATION OF FEBRILE AFFECTIONS IN THE PUERPERAL STATE.

A woman may of course acquire any of the acute or chronic fevers during pregnancy, which may persist in the puerperal state or take on new activity during that period. This is true of all the infectious diseases, but they will not be considered in detail here, with one exception. The effect of labor upon the course of phthisis has interested many observers. It has been asserted that the disease makes no progress, or at least is very much retarded, in the puerperal state. This is certainly not my experience, nor is the belief a reasonable one. Processes that often exhaust a healthy woman could not exert a favorable influence upon a wasting disease. Indeed, we have good authority for the belief that the anæmia of pregnancy, the drain of the puerperal state and period of lactation, are often accountable for the origin of phthisis.[1] In my own cases there has usually been, after delivery, an exacerbation of fever, with an aggravation of the pulmonary symptoms (see Fig. 128).

FIG. 128.



Fever Chart of Woman with Advanced Phthisis in Pregnancy and the Puerperal State.

Occasionally there will occur a rise of temperature in the puerperal state to a considerable height, and yet it will be difficult to discover a cause for the fever.[2] Our suspicions will naturally first be directed toward septic infection. The wonderful results of antisepsis in obstetric practice, the prominence of puerperal septicæmia as a subject of discussion in medical societies, journal articles, and more pretentious works, have accomplished a splendid purpose in directing men's minds to the constant danger, the ubiquitous nature, of septic poisons. But in one particular the result has been unfortunate. It is often difficult to convince a medical man that fever in the puerperal state can have another origin than sepsis. I have had a personal experience in this direction. On one occasion I called in consultation a medical practitioner to a very critical case of fever in the puerperal state that after careful study I had decided was not of septic nature. My medical friend, after a cursory examination, assured me the case was one of puerperal septicæmia, and that the patient would die. The subsequent course and termination of the case demonstrated his mistake. While it is a good rule to suspect a septic origin for every case of fever after childbirth, it should not be forgotten that there are many other possible causes for an elevation of temperature at a time when derangements of the body-heat are more common than at any other period of adult existence.

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[1] Austin Flint and Goulard: *Parvin's Obstetrics*, p. 225.

[2] Fifield: *Boston Med. and Surg. Journal*, 1884, cx. 275.

ACUTE INTERCURRENT AFFECTIONS IN THE PUERPERAL STATE.

Any of the acute diseases common to the human race may fasten themselves upon a woman after confinement. They acquire a special interest, however, in this condition, for their course is often modified, their termination often more disastrous, and their diagnosis usually more difficult. It is very puzzling, and occasionally impossible, to distinguish certain diseases, as erysipelas, diphtheria, malaria, scarlet fever, and typhoid fever, occurring during the lying-in period, from the commoner forms of septic infection to which women are so liable at this time.

PNEUMONIA.

Pneumonia does not attack women as often as it does men, but it is more fatal in the former. Pregnancy and the puerperal state are to be regarded as grave complications of the disease, for they increase the gravity of the symptoms and should make the prognosis distinctly less favorable than under ordinary circumstances. Pneumonia more frequently attacks a woman during the nine months of pregnancy than during the two weeks of the puerperal state, obviously because the period in the former case is a longer one. But the pneumonia of pregnancy often becomes a complication of the puerperal state, for frequently the disease induces a premature expulsion of the ovum at the height of the attack, and convalescence or death occurs in the lying-in period. In 43 cases of pneumonia in pregnancy collected by Ricau[1] there was premature expulsion of the fœtus in 21. From these statistics it further appears that the likelihood of this accident is increased after the sixth month. In 28 of the 43 observations the women had not passed the sixth month of pregnancy; of this number, 11 aborted. Of the other cases, however, 15 in number, in which the pregnancy was past six months, there was premature labor in 10 instances.

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[1] *Thèse de Paris*, 1874.

The PROGNOSIS of pneumonia in pregnant women is grave. Of Ricau's 43 cases, 12 died; 5 of the deaths fell among the 28 women not yet six months pregnant; 7 were distributed among the 15 who had advanced beyond this time. The infants were expelled in 21 cases prematurely; some of them were not at a viable age, but even of those which had reached sufficient development to exist without the uterus the majority died. Tarnier[1] sums up the outlook for mother and child in the following way: The more advanced the pregnancy, the greater the probability of an expulsion of the fœtus, the graver the prognosis for mother and child.

TREATMENT.—A discussion of the medical treatment of pneumonia has no place here. A consideration of the obstetrical treatment of the disease when it attacks the pregnant woman is of great practical importance, and is best handled by an obstetrician. The question that will come before him for decision will be to induce labor or to avoid interference. Pregnancy complicates pneumonia by mechanically increasing the difficulty of respiration, by calling upon the heart for extra work, and by demanding unusual facilities for disposing of the waste products of two organisms, part of which should be discharged through the lungs. It would seem, therefore, that the uterine cavity should be emptied for the mother's sake, more especially as the infant deserves but small consideration, being almost certainly doomed. But the evacuation of the uterus, the contraction of its walls, and great diminution of its blood-supply favor a determination of blood to other internal organs, among them the lungs. The exhausting discharges of the puerperal state, moreover, may fatally waste the patient's strength, while in her feeble and unresisting condition it would seem possible at least to have a general septic infection added to the pulmonary disease. Statistics certainly do not speak in favor of artificially inducing abortion or premature labor. Matton[2] says that of 18 cases in which pregnancy was interrupted, 9 women died, while in 20 women who suffered from pneumonia without aborting but 1 succumbed. Tarnier justly remarks that in the former series the disease was probably more malignant, and that this fact accounted for the abortions as well as for the fatal issue in such a large proportion; and of the 20 cases it was perhaps on account of a mild attack of the disease that none aborted and but 1 died. There are, however, 2 recorded cases in which death occurred without the previous interruption of pregnancy. Chatelain's[3] statistics include 39 cases; in 10 abortion occurred; in 9 premature labor was induced. Of the 19, 10 died, and of the remaining 20, 10 also died, showing that little was gained by the interruption of pregnancy. It must be remembered, too, that it requires considerable time and also a certain amount of operative interference to induce abortion or premature labor, and during the process the woman may die. On the other hand, it is an undoubted fact that, temporarily at least, the symptoms are often somewhat relieved after the expulsion of the uterine contents. It would perhaps be well to consider the advisability of emptying the uterus in cases where the pregnant organ was obviously a great mechanical hindrance to the expansion of the undiseased lung-space.

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[1] Tarnier et Budin: *Traité de l'Art des Accouchements*, t. ii., Paris, 1886.

[2] *Journ. de Méd. de Bruxelles*, 1872, p. 412.

[3] *Ibid.*, 1870, t. l. pp. 430, 516, and t. li. p. 11.

During the past year there have been 5 cases of pneumonia in the obstetrical wards of the Philadelphia Hospital. As the disease among pregnant and puerperal women is a rare one, and the cases in themselves were interesting, I feel warranted in giving a short sketch of them:

CASE. I.—Mary C——, X.-para, in the sixth month of pregnancy, was in the hospital awaiting confinement. She was seized one night with a violent chill, and soon developed symptoms of pneumonia in the right lung. On the third day of the disease the fœtus was expelled; it lived for five hours. At the beginning of labor the temperature stood at 103.8° Fahr.; directly after the expulsion of the child it was found to be 101.4°, but rose steadily again for two days, until the woman died, on the fifth day of the disease. The post-mortem examination showed pneumonia of the whole right lung, with "bread-and-butter" pleurisy on the same side.

CASE II.—Anne McG—— was brought into the hospital on an ambulance. She had been taken sick six days before, but had been neglected. A physical examination revealed pneumonia in a woman seven months pregnant. Half an hour after arrival in the hospital she gave birth to her infant, which only lived three hours. The woman's temperature one hour after labor was 100.4° Fahr.; it rapidly rose, however, to 103.8°, and remained high till her death, on the eleventh day of the disease.

CASE III.—Anne O'B——, I.-para, had been quite well during the whole of pregnancy. The labor, at full term, was so precipitate that no examination was made; the woman scarcely had time to lie upon the bed before the baby was born; the placenta was expressed without difficulty. On the third day of the puerperium pneumonia of the left lung developed, and shortly after pericardial friction-sounds were heard. Death occurred on the fifth day of the disease. The post-mortem examination, which I made myself with great care, showed pneumonia, pleurisy, and pericarditis. The external genitalia, the

THE EXANTHEMATA.

SCARLET FEVER.

Although this disease in the puerperal state has been the subject of much attention and discussion among medical writers, there are even yet several points in its relationship with childbed in dispute. It is not strange that there should be some confusion and difference of opinion among those who have recorded their observations of the disease among puerperal women, for its course is often much modified by the woman's condition: it may be complicated by the coexistence of some other variety of septic infection; there may be, on the other hand, scarlatiniform rashes in the course of septicæmia, although the specific poison of scarlatina may be quite excluded; and, moreover, there may be in certain cases, after infection with the poison of scarlatina, a train of symptoms undistinguishable from that which commonly follows the entrance into the body of putrefactive or pus-producing micro-organisms.

FREQUENCY.—Scarlet fever is certainly not a common complication of the puerperal state. Prior to 1876, Olshausen[1] collected 134 cases; Winckel[2] saw 1 in Rostock; single cases are likewise reported by Palmer,[3] Parvin,[4] Busby,[5] Harvey,[6] and Cummins.[7] Braxton Hicks[8] asserts that he has met with 37 cases, chiefly in consulting practice. Epidemics of scarlet fever among puerperæ are described by Boxall[9] and Meyer,[10] in which respectively 16 and 18 women were attacked by the disease. In the discussion on Boxall's paper several members of the Obstetrical Society related individual experiences with the disease. It cannot be asserted that puerperæ are peculiarly predisposed to scarlet fever. Epidemics occur, it is true, in lying-in hospitals at long intervals, but the proportion of patients attacked is never very large. During the epidemic in the Maternity Hospital of Copenhagen, described by Meyer, only about 1 per cent. of the lying-in patients acquired the disease. Boxall says that 40 women were exposed to the contagion of scarlet fever during the continuance of the epidemic, without the slightest detriment to their health. During the years 1871–85 there were only 2 cases of scarlet fever in the lying-in period among the patients at the Copenhagen Maternity; in six years but 3 cases of the kind were seen in the Hospital for Infectious Diseases (Meyer).

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[1] *Arch. f. Gynäk.*, Bd. ix. S. 169.

[2] *Path. u. Therap. des Wochenbettes*, 1878, p. 529.

[3] *Cincinnati Lancet Clinic*, 1887, p. 481.

[4] *Am. Journ. Med. Sci.*, 1884, 88, 179.

[5] *Ibid.*, 1887, p. 394.

[6] "Scarlet Fever and the Puerperal State," *N. Y. Med. Record*, 1886, xxx. 376.

[7] *Br. Med. Journ.*, 1884, i. 760.

[8] *Lond. Obst. Tr.*, vol. xii. pp. 44–113.

[9] Abstr. from *Lond. Obst. Tr.* in *Am. Journ. of Obstet.*, 1888, pp. 547, 553, 666.

[10] "Ueber Scharlach bei Wöchnerinnen," *Zeitschr. f. Geburtsh.*, Bd. xiv. S. 289.

INFECTION AND PERIOD OF INCUBATION.—Women after childbirth may be infected with the poison of scarlet fever in the ordinary manner through the throat or through the wounds in the genitalia. The latter statement has been disputed, but the short period of incubation, the fact that the rash begins often at the vulva and spreads thence over the trunk, the common occurrence of pelvic inflammations, and the fact that the diphtheritic patches usually seen in the throat of scarlet-fever patients are met with commonly in the vagina when the disease attacks a lying-in woman, while the throat is affected to a minor degree or entirely spared,—all indicate the genitalia as the point of entrance for the specific *materies morbi.* It is likely that the majority of women affected during the puerperium are infected by actual contact with the disease-germs on fingers or instruments inserted in the vagina; but it is quite possible that the poison of the disease may be drawn into the throat from the atmosphere or may be conveyed to the genitalia by the same medium. Before the adoption of antiseptic measures in surgical practice it was well understood that the poison of scarlet fever might find entrance to the body through a solution of continuity in the skin and mucous membranes. Sir James Paget long ago pointed out that the wounded become more susceptible to scarlatina.[1] The woman after childbirth is always a wounded person, and she also becomes more susceptible to attacks of the disease. This explains those cases which, exposed to the contagion during pregnancy, only manifest the symptoms of the disease after labor, the poison having lain dormant for varying lengths of time till its invasion of the body is facilitated by the wounds and abrasions which are always consequent upon parturition (Olshausen). This mode of entrance would also explain the short period of incubation when scarlet fever attacks a puerpera. Ordinarily, five to seven days intervene between the date of infection and the appearance of the first general symptoms. In the puerperal state, however, the time of incubation is shortened to twenty-four or forty-eight hours (Senn, Hervieux, Olshausen).[2]

Olshausen says that four-fifths of all puerperæ attacked will manifest the first symptoms at some time in the first three days after labor; and this assertion has been supported by the majority of the cases reported since the appearance of his article.

SYMPTOMS AND DIAGNOSIS.—A frank case of scarlet fever in the puerperal state should present no greater difficulty in diagnosis than the disease would offer under any other circumstances in the adult male or female. But it is asserted "that in rare instances the disease may assume a masked form, in which the ordinary signs of scarlatina are absent, or so slight and evanescent as to escape observation, and that in some such cases the only manifestation of the illness may be found in signs usually referred to septic poisoning" (Boxall).[1] It is, moreover, a well-recognized fact that one of the manifestations or accompaniments of septicæmia in occasional cases is the appearance of a scarlatiniform rash. And, again, there are reported from time to time erythematous eruptions in the puerperal state resembling, on the one hand, the rash of scarlet fever, and, on the other, the eruption sometimes associated with general sepsis,[2] and yet apparently unconnected with either of these diseases. Finally, there may coexist in the same individual local inflammations about the pelvic organs of septic origin and a general infection of the whole organism with the poison of scarlet fever. It is obvious, therefore, that a definite diagnosis of scarlet fever in the puerperal state may be difficult or even impossible. The diffuse nature of the rash, followed by desquamation; the characteristic appearance of the tongue; the affection of the throat; the more exaggerated diphtheroid inflammation of the vagina; the exposure to the contagion of the disease; the occurrence of scarlatinous nephritis; finally, the infection of those who come in contact with the patient, and the subsequent outbreak in them of a typical case of the disease,[3]—may serve to clear up a doubtful case. But there must remain cases in which the existence of this disease, with symptoms closely resembling sepsis, will be overlooked, or if suspected can only be inferred. Holding this view, it follows that I must differ from the author of the preceding section as regards the scope of the term "puerperal infection." To my mind, it should signify the entrance into the organism through the wounds along the genital tract of any one of the large number of pathogenic micro-organisms or their products capable of causing local inflammations or producing symptoms of general disease.

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[1] See also Hoffa: *Volkmann's Samml. klin. Vorträge*, No. 292.

[2] *Loc. cit.*

THE PECULIARITIES OF SCARLET FEVER IN THE PUERPERAL STATE.—Olshausen asserts that scarlet fever is modified in three ways when the disease appears during the puerperium: it almost always appears in the first three days after labor; the throat complications are slight; the eruption appears quickly, is rapidly diffused over the body, and is apt to assume a dark-red color. Winckel states that convalescence is commonly tedious. A careful study of the published cases must convince any one that scarlet fever exercises an unfavorable influence upon the puerperal state. The milk secretion is often lessened, if and in most cases fetid lochia is noted[1] with some uterine or pelvic tenderness; miliaria often make their appearance, especially on the abdomen under the binder, and there may be desquamation. The eruption is very likely the expression of a septic infection, usually of a mild degree; but occasionally erythema may be associated with the gravest forms of septicæmia. Mackness explains the eruption by the supposition that some septic products are evacuated through the sweat-glands, irritating the skin and producing a general hyperæmia. His theory is supported by the fact that the rash is at first punctate, seeming to begin usually at the hair-bulbs, and soon after becoming diffuse. The belief in the septic nature of the eruption is shared by Winckel, Kaposi, Maygrier, Geneix, Farre, and many others. The superficial resemblance that this affection bears to scarlet fever has led many observers into what the majority of the obstetrical world must deem an error. Perhaps some of Hicks' cases should be classed under this head. Raymond[2] would have one believe that this eruption is the manifestation of an attenuated form of scarlet fever. With some such idea in mind also Gueniot calls the rash scarlatinoid. It is likely that future investigation will confirm an opinion, already expressed, that there is an "infectious erythema" dependent upon the invasion of the body by a specific microbe, which, it is claimed, has been already isolated.[3]

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[1] Braxton-Hicks takes an extreme position in this connection. He says that among 68 cases of puerperal disease in his practice for which there was a demonstrable cause, 37 were due to scarlet fever. This is no doubt an over-estimate, and it has not met with general acceptance. Even Boxall's moderate statement, however, has a long list of names arrayed in opposition to it, but to the writer's mind the weight of evidence is distinctly in favor of his view.

[2] This word is used, in default of a better, to designate infection by the commoner pyogenic micro-organisms.

[3] See the cases reported by Palmer and Harvey, *loc. cit.*

MEASLES.

Pregnant women are rarely attacked by measles. The disease is even more rare in the puerperal state, owing to the shorter duration of the period. The measles of pregnancy, however, usually becomes a complication of the puerperium by inducing the expulsion of the ovum. 9 out of 11 cases of measles during pregnancy reported by Klotz[4] caused a premature expulsion of the fœtus. Occasionally the disease will first manifest itself in the puerperal state. Tarnier[5] describes an instance in his own experience. All writers who have touched upon measles in the childbearing woman agree that it is a dangerous disease. There is a disposition to hemorrhagic accidents, and pneumonia is a frequent and a very dangerous complication. Two fatal cases of measles during the puerperium have been reported recently in this country.[1]

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[1] Mackness, *loc. cit.;* MacDonald, *Edinb. Obst. Soc. Tr.*, 1884-85, x. 235; Charpentier; Guéniot, *Thèse*, 1862; Poupon, "Erythème scarlatiniform chez une Femme recemment accouchée," *La France médicale*, 1884, i. 41.

[2] *Thèse d'Aggregation.*

[3] Simon et Legrain: "Contribution à l'Étude de l'Érythème infectieux," *Ann. de Dermatol. et de Syphilog.*, November, 1888.

[4] *Arch. f. Gynäk.*, Bd. xxix. S. 448.

[5] Tarnier et Budin: *Path. de la Grossesse*, p. 17. A good bibliography precedes the chapter.

SMALLPOX.

The condition of pregnancy and the puerperium should make the prognosis of all the eruptive fevers more grave. This is true of smallpox as of the rest. Luckily, the disease is a rare one under any circumstances in this country, and as a complication of the puerperal state it is of very exceptional occurrence.

A case of rötheln[2] during the puerperal state has recently been reported. Any one of the eruptive fevers, of course, might constitute an accidental complication in the puerperium.

PUERPERAL ERYSIPELAS.

There is no other disease of the puerperium about which there has been such a lively discussion in regard to its relationship with puerperal sepsis. I have therefore left a consideration of the connection between the infectious diseases and puerperal sepsis to be taken up under this heading. There is a degree of confusion still surrounding this matter which, in the light of modern investigation and discovery, is surprising. Not only is this an unsatisfactory condition from a scientific point of view, but I believe that the obscurity which still invests the subject of puerperal sepsis in its relation to the poisons of infectious diseases is productive of real harm in preventing an appreciation of sources of infection which are too apt to be overlooked. Much can be done, I think, to clear away the confusion still surrounding the whole subject of the etiology of puerperal fever by discarding certain old terms until recently in pretty general use, or else by so limiting their meaning as to make them definite expressions. With this idea in mind I venture to present a classification of the febrile diseases in the puerperal state, with the hope that by so doing something may be gained toward the attainment of a definite conclusion in regard to a matter which is not excelled in importance by any other in the whole domain of obstetrics. Briefly this classification is as follows:

The phrase "puerperal fever," I think, should be taken, in its literal sense, to mean an elevation of temperature during the period of uterine involution. With this signification the term is a general one, and needs further classification and analysis. A broad division of all fevers in the puerperal state might be thus made:

I. Non-infectious;
II. Infectious.

The infectious fevers may again be further classified as follows:

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[1] Hulburt: *St. Louis Courier of Medicine*, 1887, 17, p. 549.

[2] Kite: *Boston Med. and Surg. Journ.*, August 18, 1887.

A. Those in which the infecting poison enters the system through wounds along the genital canal;

B. Those in which the infecting poison enters the system by other channels.

It is convenient to divide the infectious fevers in which the infecting poison enters the system through wounds in the genital tract into—

1. Those in which the microbes, prime cause of the evil, themselves enter the organism;

2. Those in which only the products of microbic activity, the ptomaïnes, are absorbed.

The one point about which greatest confusion reigns is in regard to the number of microbes, classed under subdivision 1, which can enter the system through wounds along the genital tract, causing local inflammations and general manifestations of disease. I think the mistake now-a-days most frequently made is in using the words "puerperal septicæmia" as a satisfactory substitute for the phrase "puerperal fever," forgetting that septicæmia is scarcely a more definite term than the simple word "fever"—that it is almost as generic in its signification, and includes within itself a large number of specific diseases. Dr. Ernst in his section points out clearly how many kinds of micro-organisms are capable, when introduced into the body through a wound, of producing a train of symptoms pretty much the same, characterized by local inflammation and suppuration, as well as by other symptoms of general body-infection. Here I think it is that the confusion surrounding this subject in the minds of gentlemen who are purely obstetricians, without much knowledge of bacteriology, can do so much harm. If one accepts the doctrine which has been quite recently advanced, that puerperal septicæmia is produced by but a single kind of streptococcus, and that such diseases as erysipelas and scarlet fever must be always regarded as intercurrent affections without connection with puerperal sepsis, he might easily neglect adequate precautions to prevent infection by the micro-organisms of these diseases; whereas these microbes, introduced into wounds along the genital canal, are sometimes instrumental in occasioning the most virulent kinds of septic fever after labor, perhaps without any of those symptoms which, under ordinary circumstances, are characteristic of the diseases in question. There is now indubitable proof to support this assertion in the case of erysipelas. It can be clearly shown that the poison of the disease when introduced into wounds along the genital canal is capable of generating a violent form of puerperal sepsis without manifesting externally that rash which is commonly supposed to be distinctive of erysipelas. It is true that this doctrine has opponents, chief among whom is Gusserow.[1] In the spring of 1879, during an epidemic of septic trouble after labor, there appeared also an outbreak of erysipelas in the wards of the Charité. From a study of this epidemic Gusserow reached the conclusion that there was no connection between the poison of erysipelas and the poisons capable of originating puerperal septicæmia. The apparently preconceived opinion of this observer found support in experiments that he made upon animals with the streptococcus of Fehleisen. He was unable to infect animals by inoculating the microbes in the peritoneal cavity, and even, in some instances, through a wound penetrating the peritoneum into the subperitoneal connective tissue. These experiments, however, proved nothing. They can be met by conflicting observations of Winckel, to which reference will shortly be made. Indeed, no one, I think, could read Gusserow's report of the combined epidemics of puerperal fever and puerperal erysipelas without suspecting that the majority of cases were really erysipelatous, while in only a small proportion did the disease manifest itself by a subcutaneous inflammation and by the consequent appearance of a rash. There is nothing proved, moreover, by cases reported from time to time in which exposure to the poison of erysipelas during childbed did not result in puerperal fever. This kind of evidence simply shows that some women after childbirth are better able to resist infection than others. The verdict in regard to the connection between the poison of erysipelas and the poisons of puerperal sepsis must rest upon positive and not upon negative evidence. In this connection the experience of obstetricians who have been placed in a situation to observe clinically the connection between puerperal infection and erysipelas must count for much. Goodell[1] has said, "that there is a relation between the diseases I am satisfied." This assertion is based mainly upon an experience with three cases of violent puerperal peritonitis which were, in all likelihood, of erysipelatous origin. The child of one woman broke out in an erysipelatous rash. The nurse in attendance upon the other two also contracted erysipelas. Dr. Goodell in the course of his remarks quoted the case of a physician who while in attendance upon an erysipelatous patient delivered seven women. Five of them died of puerperal fever without showing external evidence of the disease in a rash. Dr. Fordyce Barker[2] on the same occasion said: "The intimate relation between puerperal fever and erysipelas I consider as firmly established as is any fact in medicine." He referred to the epidemic of black tongue in Connecticut which he witnessed in the early part of his professional career, and stated that every woman who was confined at that time in the region devastated by the epidemic had puerperal fever, without respect to who was the accoucheur; and he thought every one of these women died. Dr. Barker also spoke of a physician who contracted a fatal case of erysipelas from a patient whom he attended in puerperal fever. Statistics recently gathered in Belgium show plainly the connection between outbreaks of puerperal fever and of erysipelas in certain districts.[1] In an analysis of the Belgium health reports it was found that the number of localities where erysipelas and puerperal affections were noted at the same time numbered 456, while there were only 154 districts in which puerperal affections were observed alone without accompanying outbreaks of erysipelas. In discussing Dr. Boxall's paper on "Scarlet Fever in the Puerperal State,"[2] Dr. Playfair said: "Twenty-five years ago a lying-in ward was established in King's College Hospital. The arrangement was disastrous, and was at length abandoned. During the existence of the ward there were outbreaks of erysipelas in the surgical quarter of the hospital and coincident epidemics of puerperal fever in that ward, but the lying-in patients had no symptoms of erysipelas; which, on the other hand, was seen in some of their infants." A large number of cases might be cited in which contact with puerperal-fever patients originated an attack of erysipelas, or, on the other hand, in which puerperæ exposed to the contagion of erysipelas developed virulent forms of puerperal sepsis. But the following were so thoroughly studied and are so convincing that they will suffice: In January, 1886, there was admitted to the Frauen Klinik of Munich a puerpera who had been delivered in the city. Behind the right trochanter over the region of the right ischiatic foramen there was a fluctuating surface the size of a hen's egg, which evidently had some connection with a right-sided parametritic exudate. A large hypodermic needle, carefully sterilized, was plunged into the fluctuating tumor and some of its contents withdrawn. In the pus thus obtained Fehleisen's chain-micrococcus was discovered. Pure cultures were made of it, and erysipelas produced with it in a rabbit's ear.[3] Another case from the same institution shows how the poison of erysipelas may, after its invasion of the body through wounds of the genital canal, pervade almost all the structures of the organism. A patient who presented at the same time erysipelas of the nates, ulcers of the vulva, metrolymphangitis, and diffuse peritonitis, died on the thirteenth day of her disease. In the blood taken from the heart were found Fehleisen's cocci. The same organisms were discovered in the peritonic and pleuritic exudates, in the kidneys, the liver, the spleen, and in the connective tissue of the heart-

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[1] "Erysipelas und Puerperal fieber," *Arch. f. Gynäk.*, Bd. xxv., 1885, p. 169.

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[1] Discussion on Dr. Campbell's paper, "Erysipelas in Childbed without Puerperal Peritonitis," *Tr. Am. Gynæc. Soc.*, vol. vi., 1881.

[2] *Ibid.*

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[1] "L'Érysipèle et les Femmes en Couches," Jorisenne, *Arch. de Tocol.*, xv., 1888, p. 302.

[2] *Tr. Lond. Obst. Soc.*, 1888.

[3] Winckel: "Ueber das puerperale Erysipel," Separat-abdruck aus dem *Aerztlichen Intelligenz-Blatt*, München, 1885.

36 of these developed after the delivery of the infant, 6 occurred during pregnancy. Of the cases in pregnant women, not one had its origin in the genitalia. Of the 36 cases in the puerperal state, 28 began in the genitalia, 2 in the breast, and the remainder in the face and scalp. Winckel, from an extensive study of the subject, offers the following points of evidence as to the etiology of erysipelas in the puerperal state and its connection with puerperal sepsis:

1. By far the most frequent points of origin—in five-sevenths of all the cases—for puerperal erysipelas are the genitalia and nates. There are endemics in which not a single case of facial erysipelas appears.
2. Primiparæ contract the disease three to four times as frequently as multiparæ.
3. Puerperæ with wounds upon the genitalia are particularly predisposed to the disease.
4. Those who have undergone difficult operative deliveries acquire the disease much more frequently than others.
5. The children of lying-in women with erysipelas remain in my (Winckel's) experience, free from the disease. (Gusserow in 14 cases saw the child infected twice; in Goodell's experience this happened once.)
6. The larger the number of women diseased in a puerperal-fever epidemic, the larger is also the number of erysipelatous cases.

FREQUENCY.—Erysipelas in the puerperal state manifested by a cutaneous eruption, is not a very frequent disease, but there is no doubt that a large number of cases of puerperal infection might be traced to this poison in which there is no external sign at all of the disease. To the erysipelas of childbed without external manifestation, Winckel appropriately gives the name of internal puerperal erysipelas. With our present knowledge it is impossible to give a correct estimate of the frequency with which erysipelas occurs in the puerperal state. It is equally impossible to state the relationship as regards frequency between the micrococcus of erysipelas and other pathogenic micro-organisms which are capable of producing puerperal sepsis. The writer's conviction is that the poison of erysipelas should be given a very prominent place in the list of microbes capable of producing puerperal fever.

SYMPTOMS AND DIAGNOSIS.—If the erysipelas manifests its existence by a cutaneous eruption, the symptoms are distinctive and the diagnosis is plain. If, on the contrary, the poison expends its strength upon internal organs and tissues, it may be impossible to differentiate this disease from a case of septicæmia due to the invasion of the body by the other germs of putrefaction or of pus-formation. The diagnosis can only be made if the opportunity is presented, as it was in Winckel's cases, of carefully investigating either the blood of the patient, the connective tissue of the organs, or the contents of abscesses which may form in various parts of the body.

PROGNOSIS.—If the case is one of frank erysipelas, starting from the breast or the face, the prognosis is relatively favorable. Among 14 cases of the kind described by Winckel, there were only 2 deaths. Of the 28 cases in which the erysipelas originated about the vulva, 12 ended fatally.[1]

TREATMENT.—If there are signs about rents or abrasions in the vagina or on the vulva denoting erysipelatous or diphtheritic infection, the unhealthy wounds should be cauterized. Ichthyol has been proven a valuable means of retarding the spread of the subcutaneous inflammation. This might be particularly useful to limit the extension of the disease should it progress from other portions of the body toward the genitalia. If the case is one of internal erysipelas, the treatment must be the same as that adopted in any grave case of puerperal sepsis; it might be well to test the efficacy of large doses of a tincture of the chloride of iron, which certainly exerts a beneficial action upon the disease under other circumstances.

PUERPERAL DIPHTHERIA.

What has been said of erysipelas applies as well to diphtheria. If infection occurs in the throat, the disease is an accidental complication of the puerperal state. If the infection has occurred in the genitalia, a variety of puerperal sepsis ensues that is considered in another place.

PUERPERAL MALARIA.

Malaria is something more than an acute intercurrent affection of the puerperal state, for in some important particulars the condition of the woman's organism after labor modifies the disease. The liability to infection is increased after childbirth. This is a proposition which is now beyond dispute. It has long been recognized, and will be verified by the experience of every observant physician. Bonfils[2] in a thesis has collected 140 observations of malarial fever in childbearing women, and carefully studied the articles on this subject written by Pitre Aubinais, Duboué, Ritter, Dupuy, Bureau, Göth, Pasquali, Bompiani, Cuzzi, and Mangiagalli. As the result of his investigation, Bonfils came to the following conclusions in regard to the influence of malaria upon the puerperal state and to the modifications exhibited by the disease in this condition: Malarial fever after childbirth predisposes to puerperal hemorrhages. These occur apparently in consequence of the disturbances in blood-pressure which accompany the chills and fever. The lacteal secretion is suppressed during the exacerbation of fever, but appears again after the febrile stage; it is, however, less abundant. Whether or not the milk can convey the specific poison of malaria from the mother to the nursing infant is a question which as yet remains undecided. The most striking phenomenon in the puerperal state of women already infected with malaria is the reawakening of malarial manifestations, probably by reason of the traumatism and the physical depression following childbirth. The third day after labor seems to be the usual time for the reappearance of the disease, probably because of the slight elevation of temperature and of the general excitement of the organism which accompanies the establishment of lactation. The fever preserves during the puerperal state a perfect periodicity, a characteristic which much facilitates the diagnosis. Spiegelberg and Ritter, however, stand opposed to this doctrine. In their opinion, regularity in the occurrence of fever is very rare during the puerperium. The puerperal state predisposes always to grave forms of malarial intoxication.

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[1] It goes without saying that the puerperal state predisposes to attacks of erysipelas by furnishing so many points of entrance for the poison in the wounds of various degrees along the genital canal. It would seem also that the condition of the whole organism favored the occurrence of the disease. Döderlein (*Münch. med. Wochenschr.*, 25, 1888) tells of a case in which the poison lay latent for a year in a lymphatic gland, and broke out into fresh activity after an abortion.

[2] "Paludisme et Puerpéralité," *Ann. de Gynéc.*, 1886, xxvi. 125.

These conclusions of Bonfils, while they are in the main correct, cannot be regarded as absolutely true. They illustrate the difficulty of arriving at definite conclusions in the study of any disease. Exceptions will be met with to almost every one of these propositions. For instance, I have seen malarial fever in the puerperal state, proven by the discovery of Councilman's bodies, pursue the mildest possible course, with very slight and irregular fever, which was easily controlled by the administration of quinine in small doses. On the other hand, the very worst example of malarial infection with which I have ever had to deal broke out in the last month of pregnancy. The patient had already, during the previous eight months, had two attacks of malarial fever. Within a week or two of term the disease again made its appearance in a very grave form. There were congestive chills, a temperature running to 104° and over, and finally unconsciousness. The fever was almost continuous in its type. In the midst of the disease labor came on, and after some difficulty the child was extracted by the breech. After delivery the symptoms became even more grave. It seemed that the woman's death was inevitable, but by the administration of seventy to eighty grains of quinine in the twenty-four hours for several days the fever was conquered and the woman made a rapid recovery.

DIAGNOSIS.—The diagnosis of malaria in the puerperal state usually presents many difficulties. If it were true, as has been asserted, that the fever is always characterized by distinct periodicity, this difficulty would in great part disappear, but no one, it seems to me, who has had much experience in these cases can admit the truth of this assertion. The main difficulty is to distinguish between the fever which follows septic infection and that which is a manifestation of malaria. In cases of doubt it is a good plan to administer large doses of quinine, and at the same time to thoroughly disinfect the genital canal. If this plan is followed by immediate improvement, it is always difficult to say whether there was in reality malarial infection or whether the improvement was brought about by the disinfection of the parturient tract. With the recent discoveries in regard to the etiology of malarial fever the diagnosis should not be difficult if one has at hand the necessary appliances and possesses the skill to use them. The whole subject of malarial fever in the puerperal state has been thrown rather into discredit by the tendency exhibited to conceal cases of puerperal infection under this name. The practitioner should always be upon his guard in this respect. While not so satisfactory to him, it is far safer to his patient to err in the opposite direction, to regard a doubtful case of fever during the puerperium as of septic and not of malarial origin, unless the proof in support of the latter belief is overwhelming. A French reviewer has aptly said that in these conditions there is danger that, like the dog in the fable, one may let go the booty for the shadow.

TREATMENT.—It has seemed to me that in the majority of these cases larger doses of quinine are required than under other circumstances. Reference has been made to the case in which, on the average, 75 grains of this drug were administered in the twenty-four hours for several days hand running. In another case under my observation 45 grains a day were given for a long time, with success in controlling the fever and with no ill effect upon the patient. Several times an attempt was made to reduce the dose to 30 grains, but the reduction in the quantity of the drug was always followed by the reappearance of the fever. It was at one time taught that quinine administered to a nursing woman had a disastrous effect upon her milk. This has not the slightest justification in fact. Runge, who is perhaps the highest authority upon the subject, states definitely that quinine may be given without hesitation to nursing women. Even in very large doses it does not pass into the milk.

RHEUMATISM.

Articular rheumatism in the puerperal state is either a manifestation of septic infection, with a localization of the septic matter in a joint, or else, in the acute articular form of the disease, is simply an accidental intercurrent affection. According to Celles[1] Charcot, in his doctorate thesis, published in 1853, was the first to call attention to rheumatism in the childbearing woman. During the following year Simpson in Great Britain and Virchow in Germany, in their works upon the puerperal state, mentioned articular rheumatism as one of its complications. The subject has since been studied by Peter, Loisin, Simon, Vaille, Braunberger, Boillereault, Tison, Quinquaud, Lacassagne, Hanot, Pinard, Siredey, Charpentier, Alexandre,[2] Hamill,[3] and others. The diagnosis between septic arthritis and simple acute rheumatism is not always easy. In the latter during the puerperal state one sees all the characteristic symptoms of the affection, just as under any other circumstances. Inflammation of the joints following septic infection, on the other hand, presents certain peculiar signs. The joint affected is usually a large one, very often the knee; the inflammation is not fugacious;[4] it is exceedingly stubborn in its resistance to all treatment; the duration is usually much prolonged; and in many cases there follows complete ankylosis of the joint. This affection may appear with very little evidence of general septic infection. It may make its appearance late in the puerperal state. It may be accompanied by very moderate fever of an irregular type. It is likely that in such cases a specific kind of micro-organism has found entrance to the body through wounds along the genital canal. The infecting microbe is perhaps the Streptococcus articulorum. In the worst cases of general septic infection the joints may be a seat of metastatic abscesses as well as other portions of the body, but in these cases the symptoms pointing to a general septic infection are so plain as to indicate at once the origin of the malady. There is one factor which sometimes adds to the difficulty of diagnosis between acute articular rheumatism and a septic synovitis. A metastasis has been witnessed from the joints to the peritoneum in a case of rheumatism during the puerperal state.[5] Such an occurrence would very likely arouse one's suspicion that the case was septic, and that the peritonitis and the joint disease had a common origin in a grave form of septic infection.

PROGNOSIS.—The average duration of the septic arthritis is about three months. Recovery is the rule, but with an ankylosed joint (16 justify, as yet, definite conclusions. Noeggerath and Sänger[1] take an extreme view of the frequency of this disease in the puerperium. The latter says that among 1930 gynecological cases during a single year in private and polyclinic practice, 230 (12 per cent.) owed their sufferings to gonorrhœal infection. Among 398 pregnant women, 100 had a purulent discharge (26 per cent.); 40 of the children developed blenorrhagia. This estimate is far too high to be correct. It might be true of certain localities, but the average number would fall very far below the proportion of cases that Noeggerath and Sänger believe can be discovered under all circumstances. For instance, Winckel, in an examination of 700 bodies in Dresden, had not once found a death from gonorrhœal disease of the appendages. While expressing his belief in the common occurrence of this disease, Sänger attempts to draw a sharp distinction between gonorrhœal infection and puerperal infection. He says: "If one finds in women who have borne children fresh or old perimetritic exudates, and in addition diseased adnexa, these abnormal conditions are almost always of gonorrhœal origin." The differential diagnosis between gonorrhœal and puerperal infection is, according to Sänger, to be made by the following signs: The progress of the disease in the former instance is slower. It very rarely appears in the early part of the puerperal state. It breaks out first about six or seven weeks after delivery. The most violent cases observed by Sänger were acquired during the period of uterine involution. The last statement would indicate that the experience upon which this observer bases his conclusions must have lain among a rather degraded class of patients. To my mind, it is quite impossible to draw in all cases a sharp distinction between infection by the poison of gonorrhœa and infection by the other pathogenic microbes which can occasion local inflammation in the genital tract. On the one hand, there are many of the infectious microbes which can cause a severe inflammation of the mucous membrane along the whole extent of the canal, and, on the other hand, the poison of gonorrhœa can, without doubt, excite inflammation of the deeper tissues in this region, and is quite certain, if it spreads through the tubes, to light up a sharp attack of peritonitis. The diagnosis can of course be made with approximate certainty if the disease existed during pregnancy or if a careful examination detects an inflammation of the urethra and of the vulvo-vaginal glands, or if it is possible to isolate the gonococcus. The consequences of gonorrhœa in the puerperal state can be of the most serious nature. It is not at all improbable that the organisms of this disease are capable, when absorbed in large quantities, of producing a severe form of general septic infection; witness the occurrence of joint affections in the course of a gonorrhœal attack.

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[1] Marcel-Georges Celles · "Du Rhumatisme articulaire pendant l'état puerpéral," *Thèse de Paris*, 1885.

[2] For extensive bibliography see Celles, *loc. cit.;* Félix Barral, "Contribution à Étude du Rhumatisme puerpéral," *Thèse de Paris*, 1885; Tarnier et Budin, *Traité de l'Art des Accouchements*, t. ii. p. 270.

[3] *Am. Journ. of Obstet.*, 1888, p. 317.

[4] There are, however, occasional exceptions to this rule (Barral, *loc. cit.*).

[5] Alsdorf: "Peritonitis as a Metastasis of Acute Articular Rheumatism in the Puerperal State," *Am. Journ. Obstet.*, xx., 1887, 1032.

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[1] "Ueber die Beziehung der gonorrhöischen Infection zu Puerperalerkrankungen," *Wien. med. Blätter*, 1886, S. 902.

The local inflammation under any circumstances may take on a very acute character, and may be accompanied by a violent peritonitis. There may be a rapid accumulation of pus in the tubes in the course of this disease during the puerperium. This, however, can occur just as well in the course of an ordinary septic endometritis after labor. Dr. Baldy has described a most interesting case of the kind which was relieved by an operation.[1] Perhaps a careful investigation into the cause of death from puerperal septicæmia would reveal in some instances a diseased condition of the uterine appendages, probably gonorrhœal, as the cause of the fatal termination. Grigg reports 4 cases of this kind which occurred in Queen Charlotte's Hospital. To my mind, they are not very good examples of the class. Although the appendages were diseased, it would be impossible to say that the morbid condition was not of a chronic nature dating long before the confinement, and that the general septicæmia with purulent peritonitis had not been acquired in the puerperal state on top of the older disease of the adnexa. One of these cases was exceedingly interesting as an illustration of the disastrous ultimate effects of perimetritic affections. In consequence of old adhesive bands the pregnant uterus was so dislocated that the ureters were much compressed, and in consequence enormously distended. The woman died of eclampsia, which in all likelihood was the result of the mechanical obstruction to the outflow of urine.

SKIN DISEASES.

The diseases of the skin which make their appearance during the puerperal state, and are apparently dependent upon that condition for their origin, are very likely a manifestation of septic infection. This is certainly true of the erythemata. It would appear to be true also of those cases of pemphigus which rarely occur after delivery. This disease[2] usually breaks out on the third or fourth day of the puerperal state. It may or may not be associated with some rise of temperature. In one case the contents of the blebs had a distinctly fetid odor. The duration of the disease is protracted. It lasts on the average perhaps ten weeks. It might be well in such cases to adopt at once an energetic disinfection of the genital canal, because in all likelihood the poison of the disease finds an entrance into the body by this channel. Any other form of treatment would seem to be of little avail. The woman's general condition may be weak and may need stimulant remedies. The distressing itching or burning of the skin which sometimes accompanies the disease can be relieved by soothing applications.

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[1] *Tr. Philada. County Med. Soc.*, vol. i., 1887.

[2] Croft: "A Case of Pemphigus recurring after Four Consecutive Labors," *Lancet*, London, 1887. ii. 858; Wood: "A Case of Post-partum Pemphigus," *ibid.*, 1888. ii. 468.

DIASTASIS OF THE ABDOMINAL MUSCLES IN THE PUERPERAL STATE.

If the uterus has been much distended during pregnancy, and if the abdominal muscles during labor have been called upon to exert an unusual amount of force, there may occur a wide separation of the recti muscles, leaving space between them for a hernia of the abdominal contents which can give rise to rather distressing and even alarming symptoms in the puerperal state. Prochownick[1] has reported two interesting cases of the kind. There was suddenly developed during the puerperium sharp abdominal pain with nausea and vomiting. Careful examination excluded puerperal infection, and detected the protrusion of coils of intestine between the recti muscles. The hernia was easily reduced, and a recurrence prevented by a compress and adhesive strips. In both instances the symptoms yielded at once to this treatment. This accident is not likely to be a common one among English-speaking people and in countries where the use of the abdominal binder after labor is a universal custom. Prochownick during a journey through England was struck with the small number of women in all classes of society who exhibited pendulous abdomens, and attributed, without doubt correctly, the greater frequency of this condition in his own country to the neglect of precautions after delivery to maintain the fone of the abdominal muscles and to reduce as much as possible the size of the abdominal cavity.

FLATULENT DISTENSION OF THE ABDOMEN.—There occurs occasionally in the puerperal state of nervous women an extreme distension of the abdomen, due to the over-distension of the intestines with gas. In these cases the origin of the flatulence is distinctly nervous, and should not be confounded with the same condition which accompanies peritoneal inflammation. Even in the non-inflammatory cases the great distension of the abdomen bears with it a train of symptoms always distressing and occasionally threatening in their nature. In the worst cases of the kind the only remedy which seems to afford relief is a puncture of the large intestine with a fine trocar. This procedure would appear to be devoid of danger. It has long been applied in the treatment of animals, especially sheep, to relieve the flatulent dyspepsia which sometimes follows the ingestion of too large a quantity of succulent food. It has now been also adopted with good results in human beings. Dr. Franklin of India recently communicated to Priestley of London the details of a very interesting case.[2] A young woman after the birth of her first child developed a flatulence which gave rise to alarming symptoms. Everything else failing to afford relief, the ascending colon was tapped twice—once on the third and once on the fifth day. Both operations were followed by immediate relief of the distressing symptoms. The last one cured the patient permanently. Priestley, in commenting on this case, refers to others somewhat similar, outside, however, of obstetric practice, reported by Wagstaffe in 1877 and by Broadbent in 1879. Mr. Bryant in 1872 tapped the intestine in a case of hernia with intestinal distension. No feces escaped from the opening, and but a single drop of blood oozed out. In one recorded instance the bowel was tapped twenty-eight times without bad result. Dr. Priestley gives Braxton Hicks the credit of having first suggested this procedure in puerperal cases, although he had never put it to a practical test.

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[1] "Die Diastase der Bauchmuskeln im Wochenbett," *Archiv f. Gynäk.*, xxvii. 419.

[2] Priestley: "Note on Puncture of the Abdomen for Extreme Flatulent Distension," *Lancet*, London. 1887, i. 718.

There are of course many other acute and chronic affections besides those already described which can complicate the puerperal state. They are, however, purely, accidental complications, which neither produce a distinctive change in the course of the puerperium nor are themselves modified by the woman's condition. As examples of the kind might be mentioned dysentery, intestinal parasites,[1] inflammation of the vermiform appendix,[2] miliary tuberculosis,[3] acute pancreatitis,[4] miliary fever, hepatic colic,[5] and gangrene of the ilium,[6] besides many more, the list of which will include almost all the pathological conditions to which the adult female is subject.

DISEASES OF THE URINARY SYSTEM.

Urine.—Gassner[7] was the first to point out that the excretion of urine after delivery was very much increased. In one case which he reports the quantity reached 10 kilogrammes in forty-two hours. There was in this case very well-marked œdema, but even under normal circumstances there is an increased diuresis in every healthy puerpera. Winckel has investigated this point very fully, and he comes to the following conclusions in regard to the quantity of urine excreted and to the modifications in its constituent parts during the puerperium : During the first two days the increase in quantity is most marked. The fluid is clear and of a light-yellow color. The specific gravity is very low. The absolute quantity of urea, phosphates, and sulphates is somewhat diminished, but the amount of sodium chloride is not altered. The urine gradually during the progress of uterine involution regains its normal qualities. The average amount of urine passed in the first six days reaches 11,160 grammes. The average specific gravity is 1010. The quantity passed upon each day averages as follows: the first day, 2025 c. c.; the second day, 2271 c. c.; the third day, 1735; the fourth day, 1772; the fifth, 1832; and the sixth, 1949. It is not at all rare to find albumen in the urine[1] shortly after delivery, but as this is only a temporary phenomenon, disappearing within forty-eight hours as a rule (Blot, Ingerslev, Lantos), and seems to exercise no injurious influence upon the woman's condition, it may be regarded as practically a physiological occurrence. Maguire[2] compares the albuminuria of the puerperal state with the cyclical albuminuria met with under other circumstances, and says that very likely in both these conditions the precipitate with nitric acid and heat is globulin and not serum albumen. The globulin may be separated by saturating neutralized urine with sulphate of magnesium in the cold. Lantos ascribes puerperal albuminuria to a spasm of the arterioles in the kidney, brought about by reflex irritation of the vaso-motor nerve-fibres pinched in the contracting uterus. I think it more likely due to some degree of what Gaucher[3] calls a "nephritis by auto-intoxication." The kidney is overtaxed in the struggle to get rid of the effete products of tissue-activity, the store of which is much increased in the maternal body by the life-processes of the fœtus just expelled, and by the rapid disintegration of some two pounds of flesh—the uterine muscle. The appearance of sugar in the urine after delivery is also a very common occurrence, which has been attributed to the absorption of lactose from the mammary gland; and, indeed, one observer declares that the quantity and quality of the milk may be judged by the amount of sugar in the urine.[4] But, as a matter of fact, glycosuria is more common in cases where the milk secretion fails than in others where the supply is most abundant.[5] Curiously enough, the amount of urea in the urine does seem to depend on the excretion of milk; the former increases with the increase of the latter.[6] This statement would also seem to hold good of the phosphates and the sulphates, these increasing with the urea and with the excretion of milk.[1] A modification in the urine of puerperal patients to which attention has been called in recent times presents much of physiological interest, if not of practical importance. This is the appearance of peptones in the urine of recently-delivered women. The matter has been of late quite extensively investigated, and the following conclusions appear to be justified:[2]

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[1] *Indian Medical Gazette*, xxii. 240.

[2] Dearborn : *Vermiform Appendicitis and General Peritonitis complicating the Puerperal Period.*

[3] *Centralbl. f. Gynäk.*, 1885, ix. 417.

[4] *Ibid.*, 1884, viii. 609.

[5] *Ann. Soc. d'Hydrol. méd. de Paris*, 1887, 169.

[6] *Frauen Arzt.*, Berlin, 1886, i. 308.

[7] Winckel: *Pathol. u. Therap. des Wochenbettes*, p. 11.

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[1] Examining the urine of 600 puerperæ directly after delivery, Lantos found albuminuria in 59.33 per cent. This is a more common occurrence by one-third in primiparæ than in multiparæ ("Beiträge zur Lehre von der Eklampsie und Albuminurie," *Arch. f. Gyn.*, Bd. xxxii. p. 365).

[2] "Pathology of Puerperal Albuminuria," *London Lancet*, Sept. 18, 1886.

[3] "Recherches expérimentales sur la Pathogénie des Nephrites par Auto-intoxication," *Revue de Médicine*, Novembre, 1888.

[4] Blot: *Comptes rendus*, xliii. p. 676.

[5] Hofmeister: *Ztschr. f. Phys. Chemie*, Bd. i. S. 703; Johannovsky: *Arch. f. Gyn.*, Bd. xii. S. 448. A full bibliography on this subject may be found in *Schroeder's Geburtshülfe*, 10th Aufl., p. 236.

[6] Grammatikati: "Ueber die Schwankungen der Stickstoffbestandtheile des Harns in den ersten Tagen des Wochenbettes," *Centralbl. f. Gynäk.*, 1884, p. 353.

1. Peptonuria is constant in the puerperal state. The quantity of peptones, however, in individual cases varies considerably.
2. The urine contains usually no peptone on the first day, but thereafter until the fourth day the quantity increases steadily; then begins to decrease, and disappears on the twelfth day.
3. The peptonuria is probably the result of the direct conversion of the uterine muscle into peptone.
4. After the delivery of macerated infants one finds no peptone or only a very small quantity; and this is the smaller the longer the time since fœtal death. The uterine involution seems in these cases to progress much more rapidly than after the birth of living children.
5. Occasionally peptone is found during the latter days of pregnancy. In these cases peptonuria can be demonstrated directly after birth and in the first day of the puerperium, but in lesser quantities than in other puerperæ.
6. The difficulty of a labor and its length exercise no influence upon the peptonuria.
7. The peptonuria stands in direct relation to the involution of the puerperal uterus.
8. The specific gravity of the urine is in direct relation with the quantity of peptone in it.
9. The peptones formed in the uterus behave in the blood like the digestion peptones, or like the peptones that are artificially introduced into the circulation.
10. The quantity of the peptones in the urine is in direct ratio to the number of white blood-corpuscles in the blood of the individual puerpera.

The lochia can also contain peptones, but this is independent of the peptonuria, and influences in no degree the occurrence or the quantity of peptones in the urine. A careful examination of the uterus and its lining membrane after delivery demonstrated that in the uterine muscle considerable quantities of peptones could be discovered, while in the lining membrane this substance could not be found.[3] Fischel declared that he found peptones in one-quarter of all the cases of pregnancy examined. It would seem, therefore, if this is true, that the claim which has recently been advanced for the diagnostic value of peptonuria in recognizing fœtal death during pregnancy is very slight.[1] If the urine contains albumen in considerable quantities and persistently, it is pretty good evidence of some serious trouble in the kidneys. There will be usually associated with persistent albuminuria other symptoms indicating kidney disease. One of these is acute pain, most often in the head, but sometimes referred to the epigastrium or to other regions of the body.[2] There may be œdema. There will be found in the urine microscopical evidence of degenerative changes in the renal epithelium. Albuminuric retinitis is not a very uncommon accompaniment of kidney disease in the puerperium. This may induce complete blindness, but it should be recollected that there may occur, although it is rare, a temporary blindness in the puerperal state independent altogether of kidney trouble.[3] This usually comes on shortly after delivery, and lasts for a few days. Typical examples have recently been reported by Brush and by Königstein. The latter attributes the accident to a spasmodic contraction of the retinal vessels traceable to some vaso-motor disturbance. This author thinks there may be some connection between contraction of the uterine vessels and the action of the central artery. He refers to a similar case in a non-pregnant woman due to the passive congestion of the abdominal venous system which accompanied a very exaggerated pendulous abdomen. This symptom, loss of vision, may follow severe hemorrhage or eclampsia, may be associated with albuminuria, or may be the result of a septic panophthalmitis. Königstein suggests as a treatment for the temporary blindness due to a spasmodic action of the retinal vessels the inhalation of amyl nitrate. The woman's nervous system seems to exercise a powerful influence on the composition of the urine. Cameron[4] of Montreal has recently reported an extraordinary case of high temperature and glycosuria in the puerperal state, the result of nervous influences. The range of temperature was quite remarkable, rising during waking hours and falling during sleep, without corresponding variation in pulse. The glycosuria seemed to have direct connection with the nervous phenomena and lasted only a short time.

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[1] Grammatikati: *Op. cit.*, p. 467.

[2] Fischel: "Ueber puerperale Peptonurie," *Arch. f. Gynäk.*, 1884, xxiv. p. 400, and "Neue Untersuchungen über den Pepton-gehalt der Lochien Nebst Bemerkungen über die Ursachen der puerperalen Peptonurie," *ibid.*, 1885, xxvi. 120; Biagio: "La Peptonuria puerperale," *Ann. di Ostet.*, 1887, ix. 202.

[3] Fischel: *Loc. cit.*

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[1] Köttnitz: "Ueber Peptonurie in der Schwangerschaft," *Deutsche med. Wochensch.*, 1888, No. 30.

[2] Raven: "Note on Puerperal Albuminuria," *Lancet*, London, 1888, ii. 715; Phillips: "Acute Epigastric Pain in the Puerperal Albuminuria," *ibid.*, 1887, i. 676.

[3] Brush: "A case of Temporary Blindness following Childbirth," *Obstet. Gazette*, vii., 1884; Königstein, "Erblindung nach einer Geburt in Folge von Ischæmia Retinæ," *Wien med. Presse*, 1885, xxvi. 585.

[4] "High Temperature and Glycosuria in the Puerperal State, the Result of Nervous Influences," *Montreal Med. Journ.*, Jan., 1889.

The Kidneys.—Hervieux divides the diseases of the kidneys in the puerperal state under four heads: First, inflammatory nephritis; second, metastatic nephritis; third, the evanescent albuminuric nephritis; and fourth, the subacute albuminuric nephritis. In the first stage of inflammatory nephritis one finds hyperæmia and tumefaction of the organ. Very often this is associated with general septicæmia, but one sees sometimes very much the same condition occur acutely during the last weeks of pregnancy, and end perhaps, as in one of my own cases, in fatal eclampsia during or directly after labor. If the disease develops primarily in the puerperal state, it is very likely a manifestation or an accompaniment of general septic infection, and will, in the vast majority of cases, go undetected in the midst of other complications presenting more obvious and more alarming symptoms. An intense hyperæmia of the kidney may result in an apoplexy of the organ. In the cases where this was noted there was also general septicæmia. Metastatic nephritis is of course the result of septic infection, and need be considered here no further. In the evanescent albuminuric nephritis, according to Hervieux, the kidney is increased in size. Its surface is smooth; the fibrous tunic, thickened and injected, is easily stripped off. The increase in the size of the organ is due principally to the tumefaction of the cortical substance. In the fourth variety of kidney diseases in the puerperal state the course is a more tedious one, and the disease may pass into chronic nephritis. Maguire asserts that the lesion most commonly found in cases of puerperal albuminuria is one of anæmia of the kidney with fatty degeneration, not, as heretofore supposed, a condition of passive congestion. Lantos[1] too, in the records of 39 post-mortem examinations of puerperæ who had neither died from eclampsia nor nephritis, found in 15 cases the kidney described as "anæmic," in 21 "pale," and only in 3 "congested." Among 16 women who had presented symptoms of kidney disease there were found twice acute parenchymatous nephritis, once acute hemorrhagic nephritis, nine times parenchymatous degeneration, and four times albuminoid degeneration.

The Ischuria of the Puerperal State.—The cause of the difficulty experienced in the evacuation of the bladder in such a large proportion of women after delivery has given rise to a lively discussion without, as yet, perfectly definite results. Olshausen[2] attaches great importance to the deviation or angulation of the urethral canal which is produced in consequence of the oblique position of the head within the pelvic cavity during a greater part of the labor. Schroeder[3] attributes the retention of urine after delivery rather to the increased capacity of the bladder acquired during pregnancy. In a careful study of this matter made recently by Schwarz[1] the conclusions reached, I think, are more nearly correct than either of the two just mentioned. This author attributes the greatest importance to the intra-abdominal pressure in the evacuation of the bladder, and denies, with seeming justice, the ability of the bladder-walls to contract firmly. He points out that ischuria occurs as well after the removal of abdominal tumors or the evacuation of ascitic fluids as after labor. In his opinion, the ischuria of the puerperal state is dependent either upon an obstructed urethra or else upon a lack of that intra-abdominal pressure which is always necessary to drive out the urine. Under the first head as causes of obstructed urethra might come œdema of the urethral walls and surrounding tissues; compression, deviation of the urethral canal, and a nervous inability to open the sphincter muscle.

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[1] *Loc. cit.*

[2] *Arch. f. Gyn.*, Bd. [illegible], S. 273.

[3] *Lehrbuch.*, 10te Aufl., S. 236.

The second cause, much diminished intra-abdominal pressure, is brought about, of course, by the great reduction in the size of the abdominal contents after the evacuation of the uterus. The stretched abdominal walls are unable to act with sufficient vigor to close up at once the space that has thus been gained. It has been asserted that paralysis of the bladder-walls may sometimes be held accountable for the inability of the bladder to expel its contents. This doctrine is inadmissible if one accepts Schwarz's view, that the contraction of the bladder-walls plays almost no part in the expulsion of the urine. If such a condition is, in fact, ever met with, it must be extremely rare. Winckel in an enormous experience declares that he has never seen a single case. The preventive treatment of inability to pass urine after delivery is a matter of some importance. If the patient is instructed to practise urination in the supine position during the last weeks of pregnancy, the catheter will in the great majority of instances be found unnecessary after delivery. Skutsch[2] found that among 29 puerperæ who had been managed in this way only 8 required a catheter after delivery—7 for one day, 1 for two days. Of 13 patients, on the other hand, who had not practised urination on their backs, 8 required catheterization during the puerperal state. Schatz[3] manages his cases of ischuria in puerperæ by dilating the urethra with an instrument like a glove-stretcher, until a small-sized little finger might be passed into the bladder. He claims that this relieves him from all further trouble. After one stretching, as a rule, the woman is able to pass her water naturally. Occasionally, a second dilatation is required. This might be a useful manœuvre in country practice, where the physician must travel long distances to draw the urine, or among the poor, who cannot command skilled attention. There should be no objection to the use of the catheter when it is required, in the hands of a skilled nurse impressed with the importance of clinical cleanliness.

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[1] "Zur Aetiologie der Ischurie im Wochenbett und nach der Extirpation respect. Punction Grosser Unterleibstumoren, nebst Bemerkungen über den Mechanismus der Urinentleerung überhaupt," *Ztschr. f. Geburtsh. u. Gynäk.*, 1886, Bd. xii. 86.

[2] *Verhandl. der Deutsch. Gesellsch. f. Gynäk.*, Bd. ii. 1888, p. 120.

[3] "Dilatatio Urethræ bei Ischuria Puerperarum," *Verhandl. der Deutsch. Gesellsch. f. Gynäk.*, Bd. ii. 1888, p. 118.

Incontinence of Urine.—There may be an involuntary escape of urine after labor in consequence of an overfilled bladder, of paresis in the sphincter muscle, and of a perforation communicating with the vagina and some portion of the urinary tract. The first cause in a case of the kind should always be suspected and looked for, as it is perhaps the most common. The treatment must vary with the cause of incontinence. The use of a catheter will remove the difficulty in cases under the first category. Cases of the second group are more difficult to deal with. The partially paralyzed muscle will, as a rule, regain its tone in a short time; and by an expectant treatment, therefore, one may expect to see the difficulty soon overcome. It might be possible to hasten recovery by the use of tonics, local astringents, or perhaps electricity. The preventive treatment should never be neglected. These cases almost invariably follow delayed and difficult labors with head presentations. A timely interference, therefore, would save the woman the discomfort, and even danger, of a constant dribbling of urine over the external genitals.[1]

Cases of the third order should be managed by attempting to obtain a primary closure of the fistulous opening. This can be effected in some cases, if the fistula is not too large, by touching its edges with a strong caustic like nitric acid.

Cystitis.—Cystitis is unfortunately a common occurrence in the puerperal state. It is due in the vast majority of cases to a careless, clumsy, or ignorant use of the catheter. The old plan of introducing a catheter under the bed-sheet is no doubt responsible for a large number of these cases. If physicians and nurses conduct this procedure as Dr. Garrigues recommends,[2] there would be very little risk indeed of infecting the bladder mucous membrane by the use of the catheter. A passing inflammation of the bladder may be due to long-continued pressure or to injury during birth; but such cases are rare. The cystitis is almost always a septic disease following the infection of the bladder mucous membrane by one or a number of micro-organisms. Bumm[3] claims that there is always a diplococcus to be found in the urine of such cases closely resembling the gonococcus, but possessing certain individual characteristics. This fungus is, according to Doléris, always present in the lochia, and is carried into the bladder upon a catheter. It is possible that micro-organisms can migrate from the vagina along the mucous membrane of the urethra to the bladder without the intervention of catheterization. In order that the micro-organisms, having gained access to the bladder, may bring about an inflammation of the vesical mucous membrane, it is necessary to have a condition of that tissue favorable to the invasion and the growth of the microbes. The invasion is much facilitated by a solution of continuity in the mucous membrane. It is also favored by reduction in the vitality of the vesical epithelium, which follows prolonged pressure upon the bladder during labor, or is a consequence of the over-distension of the bladder-walls from prolonged retention of urine. In the discussion that followed Dr. Bumm's paper, Olshausen declared his belief that the infecting agent in cystitis is not always the same. This is no doubt true. Olshausen also referred to a disposition of the inflammation in some cases to spread rapidly toward the kidneys, so that after the bladder affection is cured the kidney disease remains behind. There may be intermissions for some length of time of apparent health between the infection of the bladder and the outbreak of disease in the pelvis of the kidney. The termination of cystitis after delivery is, in the vast majority of cases, favorable. The inflammation may, however, persist for a long time, and may become, perhaps, an inveterate chronic affection. In the worst cases of septic cystitis the disease manifests most alarming symptoms and can end fatally.[1]

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[1] Bechadergue-Lagrèze: "Incontinence d'Urine sans Fistule consécutive à l'Accouchement," *Thèse de Paris*, 1886.

[2] See preceding section.

[3] "Die Aeteolgie des puerperalen Blasenkatarrhs nach Beobachtung an Wöchnerinnen und Thierversuchen," *Centralbl. f. Gyn.*, 1886, 443.

There is in some cases a thick, diphtheritic infiltration of the mucous membrane, which is finally exfoliated and discharged by the urethra in thick masses. In other cases, again, the mucous membrane becomes gangrenous, and is finally expelled in fragments of varying size along with the urine. Pieces of the infiltrated mucous membrane lying loose within the bladder may obstruct very seriously the outflow of urine, and the retention of the fluid adds considerably to the gravity of the symptoms. In these extreme cases the urine is full of pus, blood, albumen, and renal tube-casts, and it very often has a horribly fetid odor.

Pyelonephritis.—An inflammation of the pelvis of the kidney may follow infection of the bladder by an extension of the disease along the ureters. Very likely this is true of the vast majority of cases, but in some instances the bladder disease may be of such a transient nature that it passes undetected, and the physician's attention is first attracted by the subsequent pyelonephritis. It is possible, at least, that the infection in a case of pyelonephritis may occur in the kidneys from the blood. The disease may follow mechanical irritation from renal calculi. Within the past year, I have had two examples of pyelonephritis to deal with during pregnancy, presenting very much the same symptoms, and in each case of most obscure origin. The history of one of these cases is as follows:

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[1] Boldt: "Cystitis Suppurativa Exfoliata Puerperalis," *N. Y. Med. Record*, 1885, ii. 497.

A young primigravida in the fifth month of pregnancy, previously, to all appearance, in good health, became rather suddenly dull and stupid. Feeling quite ill she went to bed. There had been slight epistaxis and the bowels had been constipated. There was a distressing headache, and the woman's mental condition was exceedingly apathetic. She was with difficulty aroused, and answered questions in a stupid, dazed sort of way. The urine was passed involuntarily in the bed. In the course of the next two days there appeared a low muttering sort of delirium, and there was vomiting. During all this time there had been no fever. The temperature, on the contrary, was subnormal. On the seventh day of the disease the temperature began to rise. There came on a vaginal discharge which was at first catarrhal, but soon became bloody. In the course of the next twenty-four hours the fœtus was expelled. After lasting for four days the fever disappeared, but the woman's condition remained the same—great mental apathy, verging on a low form of delirium, extreme prostration, and a subnormal temperature. The only symptom which could be elicited in this case to account for the woman's state was pus in the urine, which evidently came from the kidneys, for both ureters were catheterized, and in the specimens of urine from each kidney pus was discovered. How the primary infection of the bladder occurred in this case and in the other one, which closely resembled it in many particulars, it is difficult to say. The septic inflammation having extended to the kidneys, however, it is not so difficult to understand how symptoms of general body infection should be produced. Schweizer[1] has shown that micro-organisms can pass from the urine in the kidneys into the blood, and from the blood back again into the urine. In both the cases referred to, after persisting for some weeks subsequent to delivery, the pus finally disappeared from the urine; and its disappearance was coincident with a marked improvement in the general symptoms. Both cases ended ultimately in a perfect recovery. I have seen one case of pyelonephritis during the puerperal state which was associated with renal calculi. There was a sudden exacerbation of the disease some few days after labor, associated with a high fever and a suppression of urine. The attack passed off in the course of forty-eight hours, however, and the woman finally recovered. It is difficult to lay down a satisfactory plan of treatment for these cases. The best results, apparently, are achieved by the administration of unirritating diuretics and the adoption of a tonic and supporting treatment. The disease usually ends in recovery, although its course may be a protracted one.

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[1] "Ueber das durchgehen von Bacillen durch die Nieren," *Virch. Arch.*, Bd. cx., S. 255.

Hæmaturia, when seen in the puerperal state, has almost invariably persisted from pregnancy. In these cases there are bleeding hemorrhoids of the bladder, due to the mechanical interference with the pelvic circulation by the presence of the gravid womb. The blood disappears from the urine in a few days after delivery. In bad cases of septic infection of the vesical mucous membrane, as a result of injury with instruments or as a consequence of vesico-vaginal fistulæ, the same symptom may appear, but the differential diagnosis is easy.

ABNORMALITIES IN THE MILK SECRETION.[1]

Milk secretion begins usually forty-eight hours after delivery. Previous to this time a thin fluid can be squeezed from the breast containing large cells, within which are contained many fat-globules. To this substance the name "colostrum" has been given, and these cells are called colostrum-corpuscles. It is difficult to estimate the exact quantity of milk secreted at any time, but especially so at first. The best way to determine this point is to draw the milk with a breast-pump at regular intervals during the twenty-four hours; but the breast-pump does not excite maternal emotion, hence it always draws a less quantity than would be furnished a suckling infant, for the breast is in some slight degree an erectile organ, and even the sight of the child may be sufficient to produce a flow of milk. Allowing for these errors, there will be found at the end of the seventh day about fourteen ounces in the twenty-four hours. During the five preceding days the quantity is small and variable. By the end of the fourth week the quantity of milk secreted in the twenty-four hours reaches about two pints. From this time it increases gradually until the sixth or seventh month, when about three pints of milk can be drawn from the breast in twenty-four hours. After the eighth month the quantity of milk gradually decreases. A curious anomaly of milk secretion is its occurrence independent of the puerperal state, as in very old women or very young girls, after operations upon the ovaries,[2] at the menstrual period,[3] or even in the adult male.[4] The most important abnormalities of milk secretion, however, may be grouped under two main headings: Quantitative and Qualitative.

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[1] This subject has been separated from the inflammatory diseases of the breast because, in the opinion of the Editor, the latter are so closely allied to the inflammatory conditions about the sexual organs after delivery, in their etiology at least, that they should be considered in close connection and by the same author.

[2] Penrose: *M. and S. Rep.*, 1889, 326.

[3] Sinéty: *Traité de Gynéc.*, p. 955.

[4] John Hunter's *Notes*, quoted by Barnes; Humboldt: *Reise in die Aequinoctial gegenden des neuen Continents*, Bd. ii. S. 40.

ANOMALIES OF QUANTITY.—The most frequent anomaly of quantity in milk secretion is unfortunately one of defect—too small a secretion for the needs of the infant. In its extreme degree the anomaly goes by the name of agalactia, complete absence of milk. This, however, is of exceedingly rare occurrence. Winckel in an enormous experience asserts that he has never seen an example—that there is always some little milk secretion, which may, however, pass undetected without close observation. There are a few recorded cases of complete absence of both breasts. Under such circumstances of course there would be after delivery complete agalactia, so that, although this condition is doubtless one of great rarity, its occurrence is a possibility. Defective milk secretion is by no means uncommon. Many causes may be operative in preventing normal activity in the gland. In cases of premature maternity, when the individual is not yet fully developed, one may see this condition to a marked degree, but I have on two occasions been called upon to attend young mothers not over fourteen, and in both instances the milk secretion was ample. Advanced age is another cause assigned for defective lactation. There is either an atrophy of the gland or an exhaustion by previous activity. The nearest approach to complete agalactia which I ever witnessed was in the case of a woman who had her first living child at the age of forty-three. She had been married at forty, and had had previously two children stillborn. There was in this case such a slight manifestation of milk secretion that it might have passed undetected without a careful search.

Perhaps the most frequent cause of insufficient milk secretion is a lack of development in the glandular tissue. This may be hereditary, may depend upon the continuous pressure from the clothing, or may be associated with a defective development of the remainder of the body. Altmann[1] has called attention recently to the hereditary form of atrophy in the mammary gland. This can best be studied, perhaps, in parts of Bavaria, where it has been the custom for centuries to nourish the children artificially. In Munich, of the women who did not nurse their infants, 58 per cent. were said to be physically unable to do so. Of the women who nursed their children, 70 per cent. had to resort to mixed feeding. In other parts of Germany, on the contrary, notably in Silesia, where the custom of suckling children has been carefully preserved for many generations, it is rare to find mothers unable to nurse them on account of an insufficient supply of milk.

According to Altmann, one may see the effect of heredity upon the mammary gland in the cow. The large udder which is characteristic of the domestic animal appears to have been developed by the custom of milking carried through many hundred generations; for Stumpf is quoted to the effect that in none of the Egyptian drawings is there figured a cow with an udder. In the course of his article Altmann calls attention to a fact of practical importance: in forming a prognosis in the individual case upon the likelihood of supplying the child with sufficient nutriment, one should not be influenced by the size of the mammary gland, for in some cases a large organ is made up chiefly of connective tissue, while in others apparently ill developed the gland tissue is abundant and the milk-supply ample. During pregnancy the glandular structure of the breasts takes on an active growth and devel-

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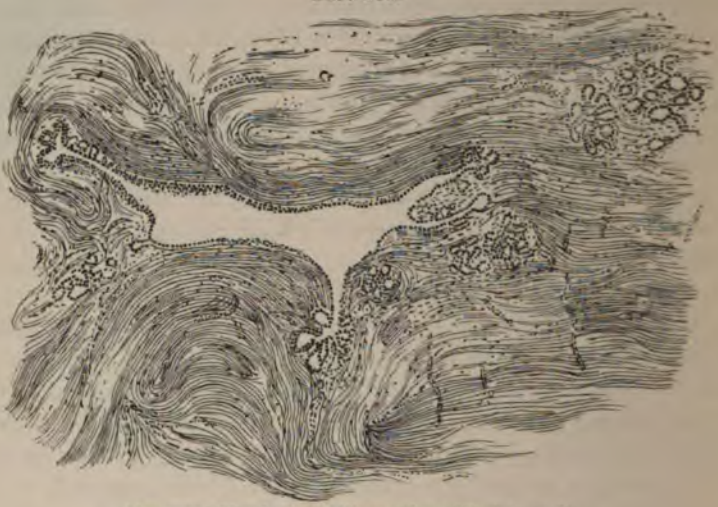
[1] "Ueber die Inactivitätsatrophie der weiblichen Brustdrüsen," *Virch. Arch.*, Bd. cxi. p. 318.

FIG. 130.



Mammary Gland of a Nullipara (from Silesia). × 52.

FIG. 131.

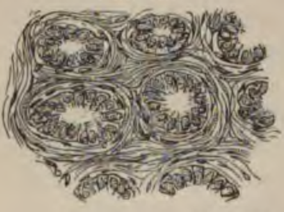


FIG. 132.

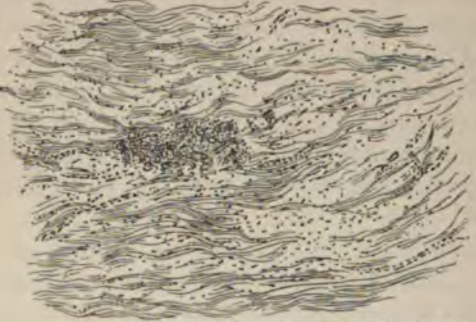


FIG. 133.

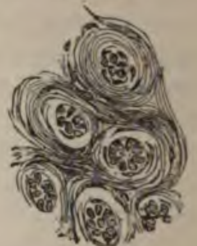


FIG. 131.—The Same as Fig. 130. × 320.
FIG. 132.—Mammary Gland of a Nullipara (from Bavaria). × 52.
FIG. 133.—The Same as Fig. 132. × 320.

opment, while the connective tissue decreases to a marked degree. If lactation is not practised, there begins at once an involution of the gland, a shrinkage of the epithelial structures, and a regrowth of connective tissue. If involution is allowed to occur after the birth of the first child, it is more difficult after subsequent deliveries to awaken the breast to functional activity.

There is another class of cases in which mammary secretion, at first sufficient, becomes at some period during the time of active lactation much diminished. This will occur sometimes as the result of hemorrhages or of diarrhœa. It may be the consequence of an acute febrile attack during lactation or of inflammation within the gland itself. Serious organic diseases may also be a cause, and insufficient nourishment must be held accountable in some cases. During the siege of Paris this was plainly demonstrated. A close observation of 43 nursing-women by Decaisne[1] proved that with imperfect nutrition the total quantity of the millk is much decreased. Of these 43 women, almost one-third lost their children from starvation. Emotions exert an extraordinary influence upon lactation. Those which are of gradual development and long continuance, as profound grief, tend to progressively diminish the amount of milk. Emotions of sudden onset and short duration, as fright or anger, either totally stop the formation of milk or else so alter its constitution that it becomes a rank poison to the child. The return of menstruation will sometimes affect the quantity and quality of a woman's milk, but not nearly so often as is popularly supposed. Zweifel states positively that for the most part the return of the menses is without influence upon lactation. This statement is in accord with the experience of Winckel, Joux, Tilt, Becquerel, Vernois, and many more. There are a few other rarer causes to which deficient mammary secretion has been ascribed. It has been said that the exit of the milk-ducts may be obstructed by an accumulation of epithelium—that this may be recognized by discovering a minute white, projecting, translucent vesicle upon the nipple at the opening of the obstructed duct. Nasal, pharyngeal, or bronchial catarrhs are supposed to diminish the quantity of milk. The mammary gland is described in some cases as torpid. A failure to furnish enough milk is ascribed occasionally to the fact that the individual approaches the male type. The milk-supply is rarely abundant after premature delivery or the delivery of dead infants. It is also an undoubted fact that extreme obesity interferes seriously, if it does not almost entirely prevent, a functional activity of the mammary gland.

TREATMENT.—From what has been said, it must appear that no single plan of treatment can be advocated to overcome insufficient mammary secretion. It must also be plain that in the vast majority of cases the cause of the difficulty is beyond the influence of any treatment. We cannot alter the age of the patient nor replace glandular tissue when it is deficient either from hereditary defects or the influence of causes which have prevented its development. There are some cases, however, of insufficient secretion that will respond promptly to appropriate therapeutic measures. If the want of milk is dependent upon a scanty diet, that can easily be corrected. It should never be forgotten that when lactation is interrupted by an acute febrile attack, lactation may be successfully resumed after convalescence is established, even though weeks and occasionally months have intervened. In cases of general ill-health or constitutional weakness much may be effected by the administration of tonics, and nutritious diet and change of air and scene. If the deficient secretion is dependent upon some emotion, the cause, if possible, must be removed. Electricity has been much vaunted of late as a remedy for insufficient lactation. It may be applicable in cases of torpidity of the mammary gland or in those cases where lactation was not practised after the birth of the first infant, and in which, therefore, the mammary gland does not respond readily to the stimulus imparted to it by subsequent births. This remedy, will, however, often prove ineffective and disappointing.

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[1] "Des Modifications que subit le lait de femme pour suite d'une alimentation insuffisante; observations recueillies pendant le siège de Paris," *Comptes rend.*, lxxiii. No. 2.

QUANTITATIVE ANOMALIES BY EXCESS in the milk secretion may take several forms. In women of a vigorous physique, well nourished, and of a full habit the supply of milk is very apt to be in excess of the infant's needs—polygalactia. Lactation may be continued far beyond the usual time—hyperlactation. In the third variety of anomalies the milk secretion continues to flow from the breasts in varying quantities and for varying lengths of time after the child has been weaned—galactorrhœa.

Polygalactia.—This condition is exceedingly common. Its treatment has been referred to by Dr. Garrigues in a preceding section. The main features of it are compression of the breast, the administration of laxatives, the regulation of the diet, and evacuation of the superabundant quantity of secretion.

Hyperlactation.—This is more frequently met with among the poorer classes. Infants are nursed far longer than they should be, either from the fact that it is difficult to provide food for another mouth, or because of the prevalent belief that lactation grants immunity from impregnation. Women have been known to nurse their children up to the second or third year. Barnes tells of a Spanish wet-nurse who suckled three successive children in one family. This practice may lead to serious results. A woman may become excessively weak, and present all the symptoms of a serious constitutional disease. The quantity of blood is diminished—oligæmia. The woman grows pale and thin; there are loss of appetite, constant headache, pain in the back, indisposition to make any physical effort, and the whole nervous system is more or less seriously deranged. Cramps in the muscles of the neck and upper extremities occur not infrequently: they appear often during the day, and last for varying periods. The application of the child to the breast often originates an attack (Winckel). There is especial danger in women of tuberculous tendencies of originating phthisis. Indeed, it is a question whether a woman of doubtful family history and a disposition to pulmonary inflammations should be allowed to nurse her infants at all.

The treatment of hyperlactation is simple and effective. The child must at once be weaned and the mother's strength restored by a nutritious diet, tonic remedies, and, if possible, change of air.

Galactorrhœa.—By this term is meant a flow of milk from the breasts, not necessarily excited by the suckling child, and commonly continued long after the usual term of lactation. The quantity of milk excreted may vary from a few grammes up to 7 litres in the twenty-four hours.[1] Usually both breasts are involved; sometimes the flow is confined to one side. The cause of this anomaly is unknown. It has been attributed to a relaxation or paralysis of the circular muscular fibres surrounding the milk-ducts, but, as Winckel remarks, this, in the majority of cases, is an effect and not a cause. There is a case recorded, however, of galactorrhœa in the left breast associated with the left hemiplegia occurring after childbirth.[2] The affection is one commonly of long duration, extending often over years. There is a case reported in which for thirty years there was an uninterrupted flow of milk from the breasts of a woman who at the time the report was made had reached her forty-seventh year. Curiously enough, this long-continued drain upon the system had had no injurious effect upon the woman's health, which remained excellent. Another anomalous feature in the case was that the return of the catamenia increased for the time the discharge of milk.[3] The usual effect of a long-continued discharge of milk from the breasts is most unfavorable upon the individual's health. It is the same that any long-continued discharge produces upon the constitution. The general debility from this cause has been dubbed, in technical language, "tabes lactea." The same condition may be seen in extreme cases of polygalactia and in hyperlactation.

TREATMENT.—The most prominent feature in the accounts of these cases is the stubborn resistance that they offer, as a rule, to treatment. In most of the textbooks on obstetrics it is asserted that there are only two measures which can be depended upon to give relief—firm compression of the mammary gland and the administration internally of iodide of potassium. It should be remembered, however, that in many of these cases the milk secretion stops spontaneously with the return of menstruation,[1] and that in a certain proportion of cases a treatment adapted to securing a discharge of blood from the uterus has been successful in curing galactorrhœa. Dr. Routh[2] warmly advocates Simpson's plan of introducing a piece of caustic within the uterus for securing this result. Dr. Abegg was successful in two instances in stopping the galactorrhœa by the use of warm douches, which brought about a return of the menses. Electricity has been recommended to secure the proper contraction of the sphincter muscles of the lactiferous ducts; but, from what has been said as to the relationship of this condition to galactorrhœa, the use of electricity must prove in the vast majority of cases ineffective. The long-continued administration of ergot has been warmly recommended; the remedy should be tried, for its use seems rational. The experiments of Roehrig[3] have demonstrated that those drugs which bring about an increased arterial pressure in the breasts promote milk secretion, while those which lower arterial tension tend to diminish or even abolish the function. Chloral was shown to be peculiarly powerful in diminishing the quantity of milk; therefore this drug is also worthy of a trial. Belladonna internally or as a local external application is usually employed as a routine practice, but it is very doubtful whether it has the slightest good effect. It has been declared that antipyrin in 2½-gr. doses, three times a day, will diminish milk secretion.[4] This remedy might be given a trial.

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[1] Winckel: *Path. u. Therap. des Wochenbetts*, p. 440.

[2] *Tr. Lond. Obstet. Soc.* for 1887, xxix.

[3] Green, quoted by Gibbons, "A Case of Galactorrhœa (unilateral)," *ibid.*

Qualitative Anomalies in the Milk.

The most important factor, from a practical point of view, in its influence upon the constitution of the milk is the diet. This is a matter which has been very extensively studied in animals: it has not been so fully investigated in the human being. It has been asserted that a fatty diet will diminish the quantity of milk very greatly. A vegetable diet is said to diminish the casein and fat and to increase the sugar. A diet rich in meat will increase the fat and casein, but will diminish the sugar. Dr. Zaleski[5] has carefully studied an interesting case in which too rich a diet so increased the quantity of the fat that the woman's milk proved injurious to the infant. By regulating the diet, cutting off a large part of the meat and prohibiting the use of beer, the cons tution of the milk was rendered more suitable for the infant's needs. After a careful analysis of the work already done in this field, particularly in animals, Zaleski comes to the following conclusions:

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[1] Gibbon's case; Abegg's cases; in two cases under the care of Depaul the galactorrhœa was arrested by the recurrence of pregnancy.

[2] Discussion on Gibbon's paper, *loc. cit.*

[3] Quoted by Gibbons.

[4] *Bull. gén. de Thérap.*, June, 1888.

[5] "Ueber die Einwirkung der Nahrung auf die Zusammensetzung u. Nahrhaftigkeit der Frauenmilch," *Berlin. klin. Wochenschr.*, Jan. 23 u. 30, 1888.

1. That a milk too rich in fat is injurious to the infant.

2. That a rich, luxurious, and too exclusive diet of albuminous substances considerably increases the proportions of fat in a woman's milk, decreases the milk-sugar, and has little influence upon the other constituents. The use of alcohol has, to a certain degree, the same effect.

3. That by a suitable diet and nourishment of the woman the desired —and for the child, in the concrete case, essential—milk constitution can to a certain degree be secured.

4. That the fat of the milk in all probability is manufactured to a great degree directly or indirectly out of the albuminoids of the ingested food.

Decaisne[1] has made an interesting study of the influence exerted by the opposite condition upon the constitution of a mother's milk. In his investigations in Paris during the siege he found that all the solid constituents of the milk were decreased except the albumen, which was increased.

The effect of emotions upon the constitution of the milk has already been referred to. What change profound mental disturbances occasion in the milk has not been exactly made out. That there is some radical alteration which converts this food into a rank poison for the infant there is no room for doubt. Baranger[2] quotes a good example: A nursing-woman saw her husband threatened by a soldier armed with a sabre. Directly afterward she gave suck to her child. It seized the nipple at first with avidity, then refused it, became violently convulsed, and died. Every practising physician has seen, at least to some degree, examples of the change produced in the milk by mental impressions. Becquerel and Vernois found that under the influence of emotion the milk of a woman contained more water, very much less fat, and somewhat more casein than was found in the mammary gland of the same individual under ordinary circumstances. Almost all acute febrile affections not only diminish the mammary secretion, but produce some change in its constitution and make it indigestible. This is most marked in the prodromal period, If a chill occurs, the lacteal secretion is suspended almost entirely for from twelve to twenty-four hours.

It would seem probable that the germs of some diseases pass from the mother's organism into her milk: this is true undoubtedly of tuberculosis. It would seem likely that the germs of malaria find an exit from the body in this way. There is a carefully-studied case which would point to the possibility, at least, that septic micro-organisms may be discharged from the breast into the milk, although the mammary gland itself is quite free from inflammation. It was observed by Karlinski:[1] there was fatal infection of the newborn from the milk of a puerpera with fever. In the milk were found staphylococci.

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[1] *Loc. cit.*

[2] "Les Contre-indications et Obstacles á l'Allaitement maternel," *Thèse de Paris*, 1884.

Women under the influence of mercurialism or saturnism excrete milk of abnormal quality, dependent, perhaps, as much upon the anæmia associated with these conditions as upon the excretion of the drug itself. The influence of syphilis upon the constitution of the milk is not yet known. It has been asserted that there is no change in the milk of syphilitic women. Vernois and Becquerel, on the other hand, affirm that there are well-marked alterations in the relative proportions of the different ingredients in the milk from syphilitic women.

Under ordinary circumstances colostrum-corpuscles may be detected in human milk for the first eight or ten days after delivery. There are certain conditions in which a return of these corpuscles may be noted. They reappear sometimes upon the return of menstruation, during acute mastitis, or in any other acute affection during lactation. Of twenty-three examinations made by Truman[2] to investigate this point, colostrum-corpuscles were found present in the following cases: In a primipara for four weeks after the birth of a premature infant. They were discovered in a woman who was suckling her four-months'-old baby; very few, however, could be detected. They were seen in a non-pregnant woman whose baby, born twenty-six months before, had been weaned for ten months. Another interesting case was that of a woman who had been married three and a half years. She had never been pregnant: ever since marriage, for a week before menstruation, the breast filled with milk. In this fluid there were colostrum-corpuscles. Another instance was that of a nursing-woman who had never been able to use her right breast during lactation. Her last child was twelve months old. In the milk which could be squeezed out of the right breast colostrum-corpuscles were discovered. Another case was one of chronic ovaritis. Twenty-three months had elapsed since the last labor, and eleven since weaning. The milk which exuded from the breast contained colostrum-corpuscles. In the breast of a woman fifty-six years old which was removed for carcinoma about a teaspoonful of milk was found, very rich in colostrum-corpuscles. The woman's youngest child was eight years old. In a case of galactorrhœa which had persisted for four years these bodies were also discovered. This fact is important, particularly from a medico-legal point of view, for it has been asserted that the presence of colostrum-corpuscles in the milk proved a recent delivery—an assertion by no means justified in fact.

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[1] "Zur Aetiologie der Puerperal infektion der Neugeborenen," *Wien. med. Wochenschr.*, 1888.

[2] *Br. Med. Journ.*, 1888, ii. p. 947.

RELAXATION OF THE PELVIC JOINTS.

The pelvic joints may after labor be the seat of inflammation, accomnied by serious exudation and ending possibly in suppuration. This, wever, is but one of the many manifestations of septic infection. e pelvic joints may be ruptured by violence during labor. This is nsidered in connection with the forceps operation and injuries to the man in labor. Finally, there may be, to a marked degree, relaxon of the pelvic joints, much exaggerated beyond that seen in almost ery pregnant woman, and persisting for varying periods after deery.

The ETIOLOGY is most obscure. Abnormal motion in the pelvic nes may be met with frequently in pelves of more than normal size: has been noted after abortion. It may be traced to a large, hard tal head which has distended the joints. It has been ascribed to sity, to a cachectic condition, to sudden and powerful exertion in the ter months of pregnancy, to an unusually great circumference of the gnant uterus.[1]

The DIAGNOSIS is easy. There is difficult locomotion, unusual moity in the joints, especially the symphysis pubis, and localized pain.

The TREATMENT should consist in the application of some kind of n binder about the hips. Tonic remedies are often required. In course of a few weeks the joints usually regain their firmness. In ne cases the relaxation persists for months.

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[1] Winckel: *Geburtshülfe*, p. 873.

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INSANITY AND DISEASES OF THE NERVOUS SYSTEM IN THE CHILD-BEARING WOMAN.

By JAMES HENDRIE LLOYD, A.M., M.D.,

PHILADELPHIA.

I. PUERPERAL INSANITY AND THE INSANITY OF PREGNANCY AND LACTATION.

DEFINITION.—The terms "puerperal insanity" and "puerperal mania" have been used by most writers both in a generic and a specific sense; but as this double use of a scientific term leads to a confusion of things which are quite distinct, although similar, it is desirable to clear away at once the ambiguity which surrounds both of these expressions. In its generic sense the phrase "puerperal insanity" has been loosely given to all the various mental diseases which assail the child-bearing woman from the moment of conception to the end of lactation, while it has been given specifically to the two or three forms of alienation which make their appearance immediately or soon after parturition, and which owe to that physiological process their origin and whatever special symptoms they may possess. It is obvious that this latter or specific use of the term is the only exact one, and that the mental disturbances which precede and follow the puerperium may be appropriately named the insanity of pregnancy and the insanity of lactation, respectively. Again, the term "puerperal mania" has been indiscriminately applied to all cases, whereas a quite large proportion of them are melancholic and not maniacal; therefore this word ought to be strictly limited to its proper special use, as it will be in this article. In spite of the fact that custom has sanctioned the double use of the term puerperal insanity, and that no better general term is suggested to include these three epochs, I have thought best to limit the phrase to its legitimate special use after this brief explanation, and with the understanding that this article covers the three periods referred to, and is intended to include all the various forms of insanity which may appear in them.

The mental diseases which accompany or follow pregnancy, parturition, and lactation do not present such special and distinct symptoms as would justify erecting them into a class by themselves, as far as their

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The mental diseases which accompany or follow pregnancy, parturition, and lactation do not present such special and distinct symptoms as would justify erecting them into a class by themselves, as far as their *form* is concerned; in other words, the mania which is excited by parturition and the melancholia which follows prolonged lactation are not specially different, if we except perhaps some few minor details, from the mania and melancholia which arise under other circumstances. "There is no peculiarity," says Prichard, "in the phenomena of puerperal madness by which this disease is distinguished from other examples of insanity." Hence those who adopt a classification of insanity based upon its clinical forms do not admit the so-called puerperal insanity as a distinct disease; but, on the other hand, they accord to these three states—pregnancy, the puerperium, and lactation—their due importance as *causes* which may excite various mental disorders. This is especially true of the German writers, Kraft-Ebing,[1] Schuele,[2] and Kraepelin,[3] who treat of these disorders rather briefly from the etiological standpoint, and do not describe them as distinct clinical forms. Spitzka[4] also, who has adopted a modification of Kraft-Ebing's classification, does not admit the puerperal forms of insanity to full membership in his groups, but prefers to designate them as the *mania in puerperio* and the *melancholia ex lactatione*, thus indicating that he recognizes nothing distinct in them but their etiological relations. In the present state of our knowledge of insanity this clinical method of classification of the Germans is undoubtedly the most complete and satisfactory, and cannot be wisely ignored by any writer of systematized psychiatry. It is just as true, however, that it may be necessary sometimes to study a disease or series of diseases from the standpoint of their causation under certain distinct circumstances and in reference to prognosis and to certain special relations, as well as with a view to treatment and prevention; and it is from this view of the subject that it must appear pre-eminently proper that the various important, and always appalling, insanities of these three periods should be discussed in a system of obstetrics.

HISTORY.—The disorders of mind in pregnant and parturient women fix the attention and excite the sympathy and imagination to so marked a degree that it cannot be wondered that the early literature of different races contains some reference to them. The peculiar impressibility of the nervous system of the female sex, and its supposed dependence for its peculiarities upon the womb and its appendages, have been, even to modern times, the fruitful source of speculative theories in neuro-pathology. Hysteria has claimed the great mass of this speculative wisdom for her own, and is in fact, to some extent, the creature of it. But pregnancy and childbirth have, with more reason, been recognized as the potent factors in many profound and enduring changes acting especially through the cerebro-spinal system. The wife of Phineas, when about to be delivered, could not withstand the shock produced by the defeat and death of her husband, which soon deprived her of reason and of life. The fable of the insane Prœtides, who spread their mental contagion to unhappy mothers, so that these killed their offspring and fled into the wilderness, perhaps symbolizes in an archaic form the perversion of the maternal instinct which sometimes accompanies puerperal mania. Under the ancient Athenian laws the house of a woman pregnant or just delivered was guarded so jealously against intrusion that a murderer could not be seized who sought refuge there; and the Romans suspended a crown at the house of the confined to indicate that it was a sacred asylum. The early medical classics have distinct references to this subject, of whom we can mention Hippocrates[1] and Galen. Among the early moderns, who reflect antiquity, Sydenham discourses at some length on this theme in his well-known epistle on the Hysteric Diseases, and gives the details of a fatal case. In 1705, Schultzius[2] wrote a Latin dissertation on the subject in which he defines the disease concisely: "Melancholia ex utero, with which the puerperal woman may be seized some days after the birth of her child, is characterized by delirium, or a perversion of the imagination, and sometimes of reason, without fever and fury, with apprehension and sadness and various other symptoms." Berger[3] published at Göttingen in 1745 a small pamphlet on the mania and melancholia of puerperal women, in which he calls especial attention to the fact that abortion may be followed by "these deliria." This publication could not have attracted much attention, and must soon have become rare, for Esquirol complains that he had never been able to find it. This serves to show with what little appreciation the systematic treatment of the subject has been received in comparatively recent times. Puzos,[4] in his treatise on obstetrics in 1759, has several papers on so-called "lacteal deposits," to which accumulations in the brain he attributes dementia or insanity. Sauvages[5] in 1771 included in his elaborate system the "paraphrosyne" of women just confined. Haslam in 1798 referred to 80 cases which he had observed in Bethlem Hospital. Rush[6] in the early part of this century refers to the disease with that perspicuity and depth which always put him a generation ahead of his time. Scattered references are found in recent writers to the meagre, and often fanciful, ideas of various well-known but now neglected authorities of a century ago, but many of these references I have not had the opportunity or inclination to explore. Thus the subject remained without orderly treatment, except for the brief and scholastic Latin essays already referred to, until Esquirol[1] wrote his paper on the insanity of pregnant and parturient women about the year 1818. This paper, it is not too much to say, arranged this subject permanently, and left it ready to the hands of almost all subsequent writers, who seem to have been content to acknowledge the originality and to follow in the footsteps of this great master. In 1820, Gooch,[2] an eminent obstetrician of London, published his observations on puerperal insanity, which have among their merits the record of a very interesting case; and a few years later (1828) Burrows printed in his *Commentaries* an extensive chapter, with statistics, on the subject. Before 1845, Prichard wrote for the English *Cyclopædia of Medicine* the article on insanity, in which he treats of puerperal madness separately and fully. In 1851, Ideler[3] wrote in German upon the "Vesania Puerperalis." In the same year Weill wrote a dissertation on the subject.[4] In 1858, Marcé[5] published in Paris his monograph on these various forms of insanity, which is by far the most complete and learned work on the subject that has ever appeared. The last complete treatise on puerperal insanity of which I have knowledge is by Rocher[6] of Paris, who wrote his thesis for the doctorate on this theme, and gives a very complete review and bibliography. The systematic treatises on insanity give more or less attention to it, Clouston[7] especially devoting a separate chapter to it as a distinct affection. Morel,[8] Guislain,[9] and Griesinger[10] refer to the etiological importance of the puerperal state, but do not recognize the disease as distinct. Statistical papers have been contributed by Reid,[11] Tuke,[12] Webster, Schmidt,[13] Leubben,[14] Ripping, Boyd,[15] McLeod,[16] and Clark. The systematic works on obstetrics for the last forty years have more or less complete reference to the subject of "puerperal mania," but show a wonderful unanimity in falling back upon the writings of Esquirol, Gooch, and, later, Marcé.[17]

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[1] *Lehrbuch der Psychiatrie.*

[2] *Klinische Psychiatrie.*

[3] *Psychiatrie.*

[4] *Manual of Insanity.*

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[1] *Works*, translated by Adams.

[2] *Disputatio Inauguralis de Melancholia ex Utero, in Puerpera Observata et Curata, etc.*, 1705.

[3] *Dissertatio de Puerperarum Mania et Melancholia, etc.*, Gottingæ, 1745.

[4] "Troisiéme mémoire sur les dépôts laiteux," *Traité des Accouchemens à Paris*, 1759.

[5] *Nosologie méthodique*, etc., traduite du Latin, etc., 1771.

[6] "Letter to Dr. John Spence," etc., *Phila. Med. Museum*, 1808, iv., No. iii. p 129.

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[1] *Des Maladies mentales, etc.*, Paris, 1838.

[2] *Trans. Col. Phys.*, London, 1820.

[3] *Charité Ann.*, ii. f., 1851, p. 122.

[4] *Diss.*, Strasbourg, 1851.

[5] *Traité de la Folie des Femmes encientes, etc.*

[6] *Étude sur la Folie puerpérale*, Paris, 1877.

[7] *Clinical Lectures on Mental Diseases*, Phila., 1884.

[8] *Traité théorique et pratique des Maladies mentales*, Paris, 1852.

[9] *Leçons orales.*

[10] *Mental Pathology and Therapeutics*, translated by Robertson and Rutherford.

[11] *Journ. Psych. Med.*, 1848.

[12] *Ed. Med. Journ.*, May, 1865.

[13] *Beitr. zur Kenntniss der puerperal. Psychosen*, Berlin, 1880.

[14] *Zur Stat. der puerperal. Psychosen*, Halle, 1872.

[15] *Journ. Ment. Sci.*, July, 1870.

[16] *Brit. Med. Journ.*, 1886, ii. p. 239.

[17] The *Index-Catalogue* of the Surgeon-General's Library supplies an extensive bibliography upon this, as upon every other, subject.

Thurnam,	of	246	insane	cases	gives	11	puerperal	insane.
Charenton,	"	256	"	"	"	10	"	"
Cork,	"	255	"	"	"	34	"	"
Webster,	"	1091	"	"	"	131	"	"
Esquirol (1),	"	1119	"	"	"	92	"	"
Macdonald,	"	691	"	"	"	49	"	"
Esquirol (2),	"	144	"	"	"	21	"	"
Guislain,	"	144	"	"	"	1	"	"
Leubben,	"	1184	"	"	"	181	"	"
		8843				781		

This gives an average of 8.83 per cent. If the exceedingly low percentage of Guislain is deducted, the average is raised not quite 1 per cent. higher. In this table Haslam gives about 5 per cent., the asylum of Charenton about 4 per cent., and Leubben about 15 per cent. These discrepancies can scarcely be explained by local differences, and must be due to errors in some of the reports.

Schmidt gives the following table of percentages from more recent observers, including Leubben:

Leubben (Halle),	15.3	per	cent.
Fürster (Charité),	16.8	"	"
Ripping (Siegburg),	21.6	"	"
Schmidt,	17.3	"	"

Some of these results cannot be explained except by peculiar circumstances which must characterize the institutions from which the statistics are taken. It is possible among the poorer and more vicious classes of large cities, where illegitimacy and privation can sometimes make of pregnancy a veritable scourge, that one case of insanity in five may be connected in a more or less remote degree with childbearing, but this proportion certainly cannot hold among all classes the world over. These figures suggest again the error of attributing to one cause too exclusively the various diseases of the mind, and excite the doubt whether other important factors may not be omitted in such an inquiry. Marcé, who has made a careful study of statistics, draws the conclusion that there is 1 case of "puerperal insanity" among 12 or 13 cases of all insane women: this is about 8 per cent. The Pennsylvania Hospital for the Insane has admitted during almost a half century 4442 insane females, of whom 360 are attributed to the puerperium and lactation. This large institution draws from the more affluent classes of the whole United States. Its percentage is also about 8. The Norristown Asylum, Pa., attributes 141 of its 2100 insane females to childbearing—about 7 per cent. The records of the Philadelphia Hospital unfortunately have not been preserved in past years so as to be available for this inquiry. Tuke's statistics, taken from Morningside Asylum, give 155 cases of "puerperal insanity" among 2181 insane females—7.1 per cent. From these various figures it appears that of all hospital cases about 8 out of every 100 females are cases with a history of recent childbirth or lactation, to which is probably partly due, either as a predisposing or exciting cause, the existence of the mental maladies of these patients.

Obstetricians will naturally be more interested in the second inquiry —the frequency of mental diseases relative to the total number of confinements. It is not possible to present statistics which are entirely reliable. The attempt to prepare such tables has been made by several authors. Reid gives the statistics of several lying-in hospitals, as follows:

Westminster = 3500 labors, 9 cases of insanity.
Queen Charlotte's = 2000 labors, 11 cases of insanity.
St. Giles = 2838 labors, 1 case of insanity.

Here, again, are obviously several sources of error or difference. The large percentage of the Queen Charlotte's Hospital is attributed to the fact that this institution received a larger number of illegitimate pregnancies than the others.

MacLeod has recently made some calculations as follows:

Years 1878 to 1882: births registered in England and Wales,	3,537,580
(Which includes plural births, estimated)	37,580
	3,500,000

From Lunacy Com. Reports there were admitted into asylums in England and Wales in these years, of puerperal insanities, 1,794 cases.

This gives a proportion of 1 case of insanity to 1950 labors. The errors are very great in this estimate, due to the fact that many cases of puerperal insanity are not sent into asylums.

MacLeod further calculates:

Reid's statistics	Labors	8338
	Insane cases	21
		= 1 to 397
Rigden's "	Labors	6000
	Insane cases	5
		= 1 to 1200
MacLeod (various sources)	Labors	11,940
	Insane cases	30
		= 1 to 398

These three estimates give 1 case of mental disorder to 469 cases of labor, and no doubt include pregnancy and lactation. Rigden's table varies widely from the others, and probably makes the average number of insane cases too low. It is noticeable that Reid's and MacLeod's results are almost identical, so that the average of 1 case in about 400 labors is probably as nearly correct as can be obtained.

CAUSES.—In no department of medical inquiry are there found such a diversity of opinions and such looseness of thought as in the etiology of disease; and this is so of the subject now under consideration. This is probably partly due to the fact that many persons lose sight of the principle—or have never learned it—that it is not within the power of the human mind to apprehend the essential action of causes, and that, therefore, being able to recognize the simple fact only that some things follow others in a regular sequence, they come to assign as causative those things which are often only precedent or coincident. This has several striking illustrations in the history of the mental diseases attending the various stages of childbearing and lactation. It does not by any means follow, as has been already stated, that the so-called puerperal insanities, or at least many cases of them, are due entirely to pregnancy, parturition, and lactation, and some of them are probably only indirectly connected with these states. Even in the cases where the causation can be most unerringly traced to these states (and such cases are the most numerous) it does not follow that there are no other important factors making up an etiological group. So, too, of certain phenomena which are really symptoms of these diseases, and yet which were formerly almost constantly mistaken for causes of them. The milk and lochia especially have been regarded with suspicion. Hippocrates says: "In women blood collected in the breasts indicates madness." Van Rossum (quoted by Marcé), supporting this opinion of Hippocrates, says that Picters had seen a woman recently delivered giving blood from her breasts instead of milk. Planchon, he says, gives a similar case dying of a gangrenous tumor of the leg (blood-poisoning?). Galen says: "The blood accumulates in the breast, and cannot be converted into milk; and because of the connection existing between the mammæ and the brain the vapors—burning or scalding—mount to the latter and mania occurs." Puzos has written of lacteal deposits or "dépôts." He says that when the milk does not follow the natural routes it may be determined toward the brain, and that the most ordinary effect of a lacteal deposit upon the brain is to produce dementia or insanity. "In spite of the dark veil which keeps from our eyes the mechanism of the brain for exciting the diverse movements of the soul, when the milk comes to deposit itself upon that organ it is able by the engorgement which it causes to compress firmly some one of these parts or to stretch the fibres to a degree of excessive tension: this compression, which produces an obstacle to the mechanical action of the brain, produces dementia; and the excessive tension of the fibres, rendering this same action too lively, causes insanity." Esquirol himself was still somewhat under the influence of the old ideas, for he speaks of "the ravages which the milk commits in the economy." Again, Hippocrates says that the lochia are carried to the head and cause maniacal transports:

this was in keeping with the humoral pathology which afterward dominated the medical world. Sydenham thinks that the suppression of the lochial flow is the cause of madness. Levret[1] has a chapter on the "apoplexie laiteuse," which no doubt signifies in part these mental states, and dwells upon the suppression of the milk and lochia. Berger enlarges to some extent upon these ideas. Some of these authors have probably mistaken pus for milk, as they speak of finding milk post-mortem in the brain and abdomen. Even Esquirol gravely tells us that he has found serum "among the folds of the arachnoid membrane, but never anything that resembled milk." It is needless to say that the suppression of the milk and lochia—which does not occur in *all* cases—is a result rather than a cause of the general physical and mental disturbances in the puerperal and allied insanities.

Among other causes of doubtful import may be mentioned the sex of the child, the use of chloroform, mammary and other abscesses, and albuminuria. These may be classed among other coincidents or results. Esquirol speaks of a patient who always became insane after bearing a male, and was always exempt after bearing a female child! It would certainly require a wide study of statistics to throw even a doubtful light upon the etiological significance of the sex of the child; and I am not aware that this has been made. In the present day, when anæsthesia is so universally used in minor surgery and uncomplicated obstetrics, it is difficult perhaps to conceive how it could be made to suffer the opprobrium of causing puerperal insanity; and yet the literature of the early days of chloroform proves beyond doubt that it was so accused, and sometimes with great injustice and acrimony. Webster[2] relates 5 cases (4 of mania and 1 of loss of memory) following the use of chloroform in parturition. The details are very meagre, the argument being little more than *post hoc, ergo propter hoc.* The query does arise, however, whether this was not rather a moral than a physical cause due to the novelty and the unusual dread experienced by the patients in taking such a mysterious and perhaps dangerous substance. The writer has frequently heard of a case—and has known personally many connected with it—where chloroform was given to a lady in her confinement about the time of its first introduction into practice. Her pregnancy had been noted for many peculiarities and changes in disposition, and her labor was followed by mania; and yet the ignorance and prejudice of her family were so great that they attributed her misfortune to the anæsthetic, and for many years blamed with injustice the physician who administered the chloroform at the patient's urgent demand. Simpson,[3] who championed the advent of chloroform, reported to the Edinburgh Obstetrical Society three cases in which it was thought that puerperal mania had been *averted* by anæsthesia, but his conclusions as to its prophylactic action have not been generally accepted. I think there can be no doubt, however, that in the transitory mania which sometimes accompanies the crisis of labor, and which may in some cases leave an enduring unwholesome impress upon the mind, the use of ether and the forceps is imperatively demanded at once. Mammary and other abscesses have been classed among the causes of mental disorder in childbed. The effect of simple abscess of the breast can be very slight unless associated with a decided anæmic state of the blood, which it would tend to continue or aggravate, and so promote nutritional disorders of the brain. The existence of abscesses in other parts of the body may be an evidence of septic or pyæmic infection of the blood, which is in some cases of great importance in causing stuporous or delirious mental states, and which will be presently referred to. The relation of albuminuria to puerperal mania first attracted the attention of Simpson of Edinburgh, who published a paper[1] with meagre details of four cases. The albumen appeared at or about the commencement of the attack. In one of these cases convulsions occurred before the delivery. The albuminuria passed away before the restoration of mental powers. Donkin[2] supported the opinion of Simpson on this subject, but based his paper on the observation of only one case—that of a woman delivered of twins who had œdema and albumen the day after, then soon became maniacal with hallucinations of the senses, and continued so for about seventeen days. The appearance of albumen and the diminished elimination of urea in the urine of patients with puerperal insanity are of importance, as tending to throw some light upon the disorders of nutrition and excretion which accompany, and even help to cause, this disorder. It ought, therefore, to be watched for in all cases. In our present knowledge, however, albuminuria, or the malnutrition which it indicates, cannot be accepted as a sole cause of these mental disorders. It is worth while to state, however, that several cases of prolonged insanity following puerperal convulsions have been reported by various writers,[3] in addition to the one by Simpson. Tuke is inclined to adopt Simpson's view.

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[1] *L'Art des Accouchemens, etc.*, Paris, 1726.

[2] *Journ. Psych. Med.*, 1850, p. 269.

[3] *An. Med. Psychol.*, 1853, p. 691 (extract).

The history of a previous attack of insanity, whether puerperal or not, ought always to suggest to the obstetrician the possibility of its recurrence, and forewarn him to meet all contingencies, such as depressing moral or physical states, which might predispose to it. The effect of pregnancy and childbirth upon women already insane will be briefly considered later. Some writers have regarded the first menstruation after confinement as a critical period, but it seems very doubtful whether it has any real influence in curing a case already established or in exciting the disease in one predisposed. In the one instance it may be regarded as a sign of the restoration of the normal functions of the body, which carries with it renewed mental health; and in the other, if it has any significance, it is probably due to increased anæmia and asthenia caused by an excessive flow of blood.

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[1] *Ed. Med. Journ.*, vol. ii. p. 761.

[2] *Ibid.*, May, 1863, p. 994.

[3] See Marcé, *op. cit.*

The causes which undoubtedly act in the most direct and uniform way to produce disorders of mind in pregnancy, childbed, and lactation can be arranged under four heads—heredity, moral impressions, anæmia, and septic conditions. The relative importance of these groups of causes cannot be succinctly stated: they have varying influence, and are combined in individual cases in various degrees. Neither do they always throw light upon the pathogenesis of the disease, although some writers appear always to confound this subject with etiology. Clouston relates a case which shows very clearly the effects of a combination of causes. A young married woman whose sister and aunt had been insane, and who had borne four dead children in rapid succession, was delivered at seven months by the induction of premature labor because of a deformed pelvis. On the second day she began to have hallucinations of sight and delusions that people slandered her, and became wildly maniacal in paroxysms. There was extreme prostration, with a temperature as high as 102°. Pneumonia at the base of both lungs came on, and the patient died. The autopsy revealed an intensely congested brain, hepatized lungs, pus on the peritoneal surface of the womb, a small abscess in the right ovary, remains of purulent adherent placenta, and a uterine vein filled with pus. Clouston thinks that this case was one of puerperal fever with maniacal delirium, rather than a case of "puerperal insanity" with septicæmia; and the distinction may pass. The important point to note is that there were in the case the combined causes of heredity, over-childbearing, dystocia, and septic infection, and that if the latter had even stopped short of taking the patient's life, she would probably have continued in a more or less prolonged insanity. The writer saw in consultation nearly three years ago a woman aged forty-two who had been delivered a month previous of her ninth child. Her maternal grandfather had been insane. She was in moderate circumstances and weighted with the care of a very large family. For a year she had been wakeful and nervous, and had had complete loss of appetite with vomiting of food. She was consequently in a very anæmic state when her last child was born. After her labor she had had much abdominal soreness and a high temperature. When seen she was in a typhoid delirious state, excitable at times beyond control in her own home. She was sent to the Pennsylvania Hospital for the Insane, where she still continues, having passed through various stages of delirium, melancholia with delusions and hallucinations, and much weakness of mind or dementia, but with a slow tendency to restore her shattered mental fabric, until she is now almost recovered. In this case there was the effect of a combination of causes, prominent among them being over-childbearing, anæmia, and sepsis, acting in conjunction with an hereditary predisposition.

No one can study the statistics of puerperal and allied insanities and not be impressed with the importance of heredity as a predisposing cause of these disorders. Schmidt reports 283 cases with an hereditary history in 102, or 35.8 per cent., and again 964 cases with an hereditary history in 386, or 40 per cent. The following table presents the results of other observers:

Macdonald	in	66	cases	of	“puerperal	insanity”	found	17	hereditary.
Reid	“	111	“	“	“	“	“	45	“
Leubben	“	181	“	“	“	“	“	55	“
Stephansfeld	“	30	“	“	“	“	“	14	“
Webster	“	131	“	“	“	“	“	51	“
Total,		519						182	
About 35 per cent.									

These percentages would no doubt be raised if it were possible to elicit a full family history in all cases. The difficulties attending such an inquiry are twofold: first, the ignorance which many persons have of their family histories; and, second, the skill and perversity with which they or their friends will conceal or distort facts which prove a family history of insanity.

As to the more obscure questions involved in heredity, the evidence of it in morphological and other somatic states or alterations, as influencing these and all other forms of insanity, this is not the place to enter into a prolonged discussion, especially as much is still unknown or only partially revealed, and the subject involves too wide an inquiry to be included in this special study. It is sufficient for our purpose to indicate that about 35 per cent. of these cases have an acknowledged family history of insanity.

The moral state during pregnancy and parturition is deserving of careful observation and study as contributing to the causation of mental disorders. It does not come within the range of the microscope, nor is it revealed by the mechanical methods which prevail in the modern clinic, and therefore it may suffer some risk of incurring disfavor, for there are even those who write especially on this subject who affect to ignore it. But it appeals strongly to the philosophic sense of those who attempt to study disorders of the mind from a psychological as well as from a merely physical standpoint, and has been regarded as of paramount importance by the most eminent authorities, such as

Esquirol and Griesinger. "The psychology of pregnancy," says one very acute observer, "has yet to be written in a scientific way." It is a matter of common observation that few women carry a child to full term without showing some mental changes. These alterations are most frequently of temperament and disposition, or are shown by whims, caprices, and unusual or bizarre tastes and desires. The lower centres of the nervous system share often in these disorders, a certain instability both of the motor and sensorial functions being noted, involving sometimes derangements of the great viscera. Pregnancy tries the endurance and pose, as it were, of the mind—its capacity to face privation, discomfort, danger, and, in the case of the primiparous woman, unknown and exaggerated horrors. In no walk of life, where great cares of business or of state have at least their compensation, in no scene of action or danger, where applause and heroism have their stimulation and reward, can there be found a more dismal and alarming conflict than that which in her imagination presents itself to the youthful, delicate, and untried woman when, alone and to a great extent unaided, she first faces the inevitable hour. With the rumors and traditions which her curiosity has gathered in since first she learned the secret of generation, she endures the anxious suspense of many weary months of waiting, while during this period she often suffers much physical discomfort, and sometimes serious nutritional change. That this should affect her imagination, depress her spirits to the verge of melancholy, and even sometimes jeopardize her reason, will not be wondered at, I think, by those who engage extensively in obstetric practice. That to some degree these mental affections do occur very frequently, and not exclusively in primiparæ, will be equally allowed. If this psychic condition finds a soil predisposed by heredity and prepared by anæmia, a painful and protracted labor, or the loss of the child, or still more poisoned by any septic infection, the wonder is still less that in a certain proportion of these unfortunates grave mental disease results. The proportion of primiparæ among those who suffer with simple acute mania is shown by statistics to be large; and this preponderance is no doubt due in part to the mental and moral alterations which are peculiar to, or more marked in, the first pregnancy.

Fordyce Barker[1] has recorded a curious experience. He has seen thirteen cases of puerperal insanity in the wives of physicians—all but one of them primiparæ—and attributes the fact to their reading their husbands' books on obstetrics! The statistics of Morningside Asylum show that about one-third of all puerperal cases occur in primiparæ; which is, of course, as Clouston says, out of all proportion to the number of first confinements in the population.

In multiparæ, however, the case is sometimes not much better. For while the sense of personal danger is often less in them, it is by no means always absent; and the writer is sure that he has seen it exist in some to as morbid an extent as in their more inexperienced sisters, while they have in addition to support, not unfrequently, the cares, vexations, and anxiety which too many children and too limited means impose, especially upon so many worn-down women, to whom, in the logic of events, domestic life has become a servitude and childbearing worse than a disease. In some of these cases it does seem that melancholia is the normal reaction of the mind to its environment, and mania only a consistent though incoherent protest against this procreation of unhealthy seed. This is no pessimistic view. The privileges, charms, and duties of maternity need no apologist, but a defence is certainly to be allowed to the suffering women who daily exemplify the primeval curse that in sorrow they shall bring forth children.

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[1] *Puerperal Diseases*, Lect. x.

The effect of moral influences is shown also in cases of illegitimacy. Esquirol in his early paper noted this effect, and had especial opportunities to observe it in a hospital which received the poor and abandoned cases of Paris. Clouston found about 25 per cent. of his cases to be illegitimate, whereas the average rate of illegitimacy of Edinburgh—from which city and neighborhood many of his patients probably came—is about one-third of this. These figures are significant, and confirm the truth of the observations which many have made upon the deplorable effect of seduction upon susceptible minds. This effect is sometimes seen even when the guilty indulgence is not followed by pregnancy. The writer knew of a case of a very respectable girl whose secret might have remained for ever her own, but who confessed her trouble to her medical adviser, became profoundly and morbidly melancholy, and committed suicide. This effect will of course be much more likely to follow in cases of illegal pregnancy, where the apprehension of publicity, the shame, the dread of that cruel social verdict which renders life worse than death, prey upon the mind for months; and in addition the care, the moral support, and physical comforts, which the primiparous woman especially so often needs, are not only not enjoyed, but shunned as making necessary the dreaded exposure. "If puerperal insanity," says Ideler, "under most favorable circumstances is not hard to explain from psychological causes, it is not difficult to conceive its occurrence in the pitiable martyrs of sexual lust;" and he quotes the words of Lessing, that the person who does not lose the mind under certain circumstances has none to lose. Some writers do not attach the importance to this subject which it seems indubitably to merit; and it is but fair to say that statistics vary and are open to criticism. The Norristown Asylum has treated 112 cases of the insanities of pregnancy, parturition, and lactation, and *not one* of these women was unmarried. This hospital draws largely from the rural districts of Pennsylvania, where the rate of illegitimacy must be very much less than in large European cities. Morel[1] says that he believes that puerperal mania seizes the virtuous mothers of families more frequently than the women who, especially in Paris, find to such an extent the means of concealing their shame and relieving themselves of the fruits of their criminal loves; and the rest of the world will probably agree with him as to the exemption of the Parisian courtesan.

Impoverishment of the blood is a not infrequent condition accompanying pregnancy, childbirth, and lactation. That it is often a very active cause in the production of mental disorder there can be no doubt. As far as personal experience goes, based both upon obstetric practice and ample opportunity to study all forms of insanity, I have never yet seen one of these cases of puerperal and allied insanity that has not helped to confirm this impression; and it seems probable that to this fact is to be ascribed the favorable termination of so many of these cases, because this potent factor in the causation can often be so successfully treated and overcome. This impression is based rather upon general observation than upon minute examination of the constituents of the blood. I believe, of course, that such minute examination ought always to be made, as throwing light upon causation and furnishing hints for treatment. A few original observations are recorded in this paper.

Pregnancy and parturition are sometimes productive of a grave form of anæmia, as observed originally by Channing and Gusserow.[2] It occurs especially after delivery, and has been included in the group of progressive pernicious anæmias. In this dyscrasia the number of red blood-corpuscles is greatly reduced, far beyond what occurs in the most severe hemorrhage or in the most exhausting diseases, such as cancer and phthisis. The normal supply of red corpuscles is about 5,000,000 to the cubic millimeter, but in this form of anæmia the number may fall to 1,000,000 or even as low as 300,000. The hæmoglobin is also greatly reduced. Eichhorst collected the reports of 91 cases of pernicious anæmia, of which 19 developed during pregnancy and 10 after delivery.

It is in obstetric practice especially that this tendency to blood-impairment in the childbearing and nursing woman is seen, and is very often to be noted, of course, in women who do not lose their reason. Very many women can withstand for the necessary time the drain upon the system which these conditions entail, but in the occasional case where, as before stated, a variety of causes act together and favorably, the anæmic condition may be the immediate predisposing one. Kraft-

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[1] *Traité théor. et prat. des Maladies mentales*, Paris, 1852, vol. i. p. 106.

[2] See Osler's art. on "Progressive Pernicious Anæmia," *Am. Syst. of Med.* Laveran and Teissier, *Pathologie médicale*, art. "Anémie," vol. i. p. 347, have an extensive bibliography on the subject.

Ebing quotes Ripping and Schmidt as proving that diminution of weight has an influence, and that the psychosis disappears with the return of body-weight. The consensus of opinion among writers is that the physical state accompanying the mental diseases of these three periods is anæmic. The causes which in turn produce anæmia in childbearing and nursing women are various. Prominent among them is the constant drain upon the system of supporting the new life. This appears to act more upon the nursing than upon the pregnant woman, nature often causing a compensatory plethora, as it were, in pregnancy, which is not the case during lactation. I should say that of the relative occurrence of moral and anæmic causes, the former were more frequent before childbirth, and the latter during lactation. Anæmia and altered blood-states are not absent, however, in all cases during pregnancy; and the cases which develop puerperal mania are probably, in large proportion, some of those which have had such alterations in the blood. In this connection it may be well to call attention again to Simpson's view, that albuminuria is present in some of these cases, and that a number of authors have reported insanity following eclampsia. I once delivered a young primipara who had had frequent vomiting and loss of appetite, albuminuria, and œdema of the feet, with some visual hallucinations, and who went into premature labor at the end of the eighth month. She had no convulsions and rather an easy labor, but the child, unfortunately, was very feeble and lived but a few hours. This patient became abnormally melancholy for a time, and changed in her disposition toward relatives, and was quite morbid about her child. Her case exhibited, fortunately, only the transient effect of these causes.

Flooding after labor has been noted in a certain number of cases, and can be a cause of an anæmic basis for insanity. The practice of free bleeding for puerperal convulsions cannot be ignored in connection with mental disorders following eclampsia; and one writer is confident that in a case observed by him the anæmia so produced had as much to do with the insanity as the nerve-storm through which the patient had passed.

The relation of septic infection to the causation of mental disorders in the puerperium is a question of very great interest and importance, about which, unfortunately, we have not very certain and accurate knowledge. From some clinical experience, however, and a somewhat extended study of both the older and more recent observers, I am convinced that this relation is often intimate, and ought always to be suspected and guarded against. The knowledge which we have of septic infection in all conditions is, most of it, comparatively modern; and this knowledge has been extended and systematized at so recent a day that there is little wonder that so little light has been shed upon this phase of it. A partial survey of the literature of this subject reveals the fact that a more or less distinct variety of puerperal mania has been recognized from a very early date; and the description given of this peculiar variety by those who record original observations leads to the belief that it owed its distinctive symptoms to septic infection. Hippocrates[1] relates the case of a woman who had brought forth twins. Her symptoms were suppressed lochia, chills and a fever, insomnolence, dulness, and incoherence; on the eleventh day, wild delirium; on the fourteenth day, convulsions and suppression of urine; sixteenth day, loss of speech (coma?); seventeenth day, death. The diagnosis was phrenitis. The author thought death was caused by the affection of the brain consequent on her accouchment. This case differs from a simple, acute non-septic mania, and bears evidence of septicæmia with typhoid delirium. The diagnosis of *phrenitis*, as applied by Hippocrates to this class of cases, appears to have been adopted by writers down to the present century. This is evidently due partly to the weight of medical authority, and partly to the pronounced cerebral character of many symptoms which were never verified by post-mortem research. The symptoms do not require, however, to be explained by inflammation either of the brain or its membranes. The earlier writers of modern times have formulated rules for diagnosis or prognosis based upon the recognition of this peculiar type. William Hunter,[2] in his manuscript lectures, says: "Mania is not an uncommon appearance in the course of the month, but of that species from which they generally recover. When out of their senses, attended with fever, like paraphrenitis, they will in all probability die; but when without fever it is not fatal, though it (fever) generally takes place before they get well." Gooch[3] refers to those who say that puerperal mania may be confounded with phrenitis (meaning, evidently, an excited delirious state due to fever—*i. e.* sepsis?), but does not admit the rules of others for distinguishing the two conditions; and then gives his own rules for distinguishing them, which are not much better. The interesting fact is that he recognizes the importance of differentiating some febrile, delirious conditions from simple afebrile puerperal mania. Guislain[4] draws a distinction between simple puerperal mania and puerperal meningitis. The latter is preceded by *abdominal pains*, has intense heat, and is very fatal; it is also characterized by sweats, and passes promptly into coma. This seems to be what others have called phrenitis, and is probably a septic condition with localized peritonitis. Rocher[5] thinks a high temperature may appear if the woman is under the influence of the milk fever. This is a proper distinction, but the other symptoms of septic infection would of course not then be present. Clouston is one of the few authors who give due prominence to sepsis as a cause of insanity in childbed. The temperature of all his cases was taken and recorded, with the following results: Of the 60 there were 34 cases under 99° ; 26 cases, or 43 per cent. of the whole, were over this, and 14 cases, or 23 per cent. of the whole, were over 100°. No other form of insanity, says the author, shows this alarming result. It is significant that all the deaths occurred in cases with a temperature over 100°, but all cases with very high temperature were not fatal. The causes of the high temperature were considered to be brain-excitement, inflammation of the womb, meningitis, and incidental causes, as malaria and mammary abscess. The relative importance of these causes is not stated, but sepsis seems to be the most definite of them all, and can account often for the others, as brain-excitement and possibly meningitis. Clark[1] gives details of 40 cases of puerperal insanity proper, of which number 18, or nearly 50 per cent., had septicæmia or simple inflammatory trouble about the uterus. Dr. Barton C. Hirst has reported 2 cases of primipara, illegitimately pregnant, who exhibited, as before insisted upon, a combination of causes, among which was sepsis: 1 died, the other recovered. In both these cases the moral element was seen in the character of the insanity, which was of a melancholic religious type, the patients dwelling constantly upon the sin they had committed, with prayers for their forgiveness. Dr. Alice Bennett of the Norristown Asylum has communicated to me the particulars of the following case, in which it seems probable that sepsis was the cause of a sudden and unlooked-for death: A married woman, aged thirty-five, primipara, whose sister had died insane after confinement, became violently insane ten days after the birth of her child. On admission to the hospital on the fifth day of her attack she was acutely maniacal, with a small, feeble pulse and indistinct heart-sounds. The perineum was torn and the cervix uteri was deeply lacerated and eroded. The temperature was not recorded. The urine was not albuminous, but presented a few hyaline casts. The patient took food, slept some, and appeared to improve for a few days, and the lochial discharge, which had been suppressed, was seen for the first time. It again disappeared on the eleventh day, and the patient had a chill, followed by a temperature of 103° and profuse perspiration. She collapsed and died the same day. In this case there were heredity, advanced age for a primipara, and so probably dystocia, and the local conditions favoring septic infection. Another case in the same hospital had had retained placenta, which had been discharged in pieces for some days, and had had inflammation and fever for three weeks. She was violent, delusional, and engaged frequently in prayer. She recovered, but had a good family history to fall back upon, otherwise she might not have got well in three months.

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[1] *Epidemics*, Bk. iii., Adams' translation.

[2] Quoted by Prichard, art. "Insanity," *Cycloped. of Med.*, p. 68.

[3] *Op. cit.*

[4] *Leçons orales*, vol. i. p. 356.

[5] *Op. cit.*, p. 40.

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[1] *Journ. Ment. Sci.*, July, 1887.

The delirium of septicæmia is not necessarily insanity, and the necessity of distinguishing a transient flighty state of the mind, due to any form of blood-poisoning, from a more enduring psychosis, is of great importance, both from a scientific and a personal standpoint. The greatest assistance to this diagnosis will probably be rendered by an attentive study of the antecedents and family history of the patient. If she is sprung from a neurotic family, one especially in which well-authenticated insanity has existed, and has been burdened with family cares, and is in an anæmic and prostrate condition, the probability is that her septic condition has been the one necessary cause to precipitate her into an alienation of mind; which will be more or less prolonged, and which may require the isolation and perfected system of a well-regulated hospital to terminate in the shortest time. If the patient's social and domestic circumstances are such that she can be properly treated at home with the most approved antiseptic methods, it may be worth while to test for a time her recuperative powers and the relative importance of the sepsis as a cause of her mental disorder by a continuance of a well-regulated treatment in her own house. A return to mental health, however, does not by any means invariably follow the disappearance of all symptoms of septic infection. This distinction is of great personal importance to the patient in her future relations in life, as well as to the physician who may assume the responsibility of certifying her to an asylum.

I have dwelt purposely at some length upon the causation of these forms of insanity, because they have, as before stated, more etiological than clinical significance. Some cases undoubtedly occur where the causation is obscure, and in which none of the elements referred to appear to have great importance.

SYMPTOMS.—The forms of insanity usually observed in the three periods under consideration are mania and melancholia. A third division has been made by some writers, following the older authors, into dementia. This last division is not a fortunate one, because the term "dementia," as used now at least, is confined almost exclusively to the terminal state of mental feebleness and decay into which all the forms of insanity tend to deteriorate. Thus the initial attacks both of mania and melancholia may terminate in unfavorable cases in dementia; and it is very probable that in the statistical tables of some observers the dementia of patients had been preceded by an initial attack of one of these two forms. There are, however, states of mental weakness, not necessarily chronic or incurable, to which the term dementia, especially *primary* dementia, has been given; and some of these cases of stuporous, fatuous, and confusional states have probably been included in the tables under the general term dementia. Other forms of insanity have probably also been included in these three groups, which do not properly belong to them. It is possible that some genuine monomaniacs—by which term we now mean the constitutional and hereditary class of the insane with systematized and unalterable delusions—have come into these statistics; and a very few writers refer to having seen general paresis originate in, or precipitated by, an original attack of so-called puerperal insanity. It is impossible in this paper to attempt an exhaustive criticism of terms; but it is important to again call attention to the fact that there is nothing specially distinctive in the symptoms of the insanity which occurs in childbearing and nursing women; that the *form* of insanity which the case may assume varies according to other special relations, conditions, and individual peculiarities, and that these cases in almost all instances will be found to owe their origin to a combination of causes, of which pregnancy, parturition, and lactation contribute only a share. Again, mania and melancholia (which are the most common forms of alienation seen in these connections) may be present in the same patient, as is constantly seen. These terms include in themselves only superficial symptom-groups, which owe their origin to profound changes in the alimentation and nutrition of the brain. It is not uncommon to see a prodromal state of melancholia ushering in a very active mania, which in turn soon shows fragmentary or partially systematized delusions, with hallucinations of the senses; the attack passing into a state of feebleness or critical dementia before recovery. While these terms are thus subject to criticism, however, the fact remains that in most cases the prevailing type, as we may call it, is either melancholia or mania; and while the maniacal patient may have her temporary fit of depression, or the melancholic have her transient states of excitement, the two are sufficiently distinct to the mind of the alienist to continue always to hold their places in nosology. The insanity of pregnancy is most frequently melancholia; of the puerperium, mania and delirium; and of lactation, melancholia. Kraft-Ebing says that of puerperal insanity proper three cases to one are maniacal. Of Esquirol's 92 cases, 49 were maniacal, 35 melancholic, and 8 demented. Schmidt gives the following table. Of a total of 283 patients in the three stages, pregnancy, childbed and lactation, the proportions were—

Mania	123	=	43.5 per cent.
Melancholia	118	=	41.7 per cent.
Delusional insanity	20	=	7.0 per cent.
Dementia	14	=	4.9 per cent.
Dementia paralytica	6	=	2.1 per cent.
Circular insanity	2	=	0.7 per cent.
Total,	283		

This table, as will be seen, does not present the relative frequency of these forms in the three stages, but the general statement already made will suffice.

In this connection, when about to study the symptoms of mental disorders in childbearing women, it may be well to view these disorders first in their relative frequency in pregnancy, parturition, and lactation. Schmidt's table is as follows:

Of 264 cases,	in pregnancy there occurred	47	=	17.6 per cent.
	in puerperium " "	130	=	49.3 per cent.
	in lactation " "	88	=	33. per cent.

These results agree very closely with Ripping.

The combined statistics of Esquirol, Hanwell Asylum, Macdonald, Marcé, York Retreat, and Palmer give a total of 310 cases, divided as follows:

Pregnancy	27	=	8.7 per cent.
Puerperium	180	=	58. per cent.
Lactation	103	=	33. per cent.
	310		

Tuke gives 155 cases, as follows:

Pregnancy	28	=	18.00 per cent.
Puerperium	73	=	47.00 "
Lactation	54	=	34.00 "
			99. per cent.

These statistical results vary somewhat, but are nearly enough in harmony to give a correct idea. There are several fallacies to be guarded against, however, in reviewing them. The mental disorders of pregnant women may be slight, as alterations chiefly of disposition, with irritability and eccentricity, and yet these alterations stand as prodromal to a fully-developed attack of mania in the puerperium. Some observers may date the disorder from the pregnancy, others only from the fully-developed attack in childbed. So, too, of mental disease during lactation; it does not follow that all cases so labelled have been strictly limited to this period: *per contra*, many of them may have shown alterations in their mental states during the pregnancy; and it may so happen that the case which one observer includes in one period another may include in a prior state, depending upon the symptoms which may strike each of them as initial, or the period in which each happened to first observe the case.

This again illustrates how futile it is to attempt to establish a complete classified system of so-called puerperal and allied insanities, ascribing to each period or epoch distinctive symptoms, and with a definite arrangement of diagnostics, prognostics, and treatment; and it emphasizes the fact that these forms of insanity and the periods of their occurrence must be grouped together and portrayed with reference to their general and special etiology.

Pregnancy, as before stated, is the cause or occasion of various mental changes and disorders. Many of these cannot be regarded as pathological, such as the changes in temperament, the caprices, and altered tastes and fancies, and even the alterations in the so-called affective faculties, as shown by slight perversion of the affections and moral sense. Some of these states and symptoms, however, border very closely upon distinct mental disease (which is, after all, but a relative term), and are of significance in this connection; while others have a nice medico-legal importance in reference to responsibility in case of thefts and other infractions of the civil law due to the longings and impulses of the pregnant woman, and especially in the case of subsequent homicidal and suicidal attempts. The most common disorder of mind observed during pregnancy is melancholia. The number of these cases observed and reported in asylums is certainly nowhere in proportion to the prevalence of such disorder in the sum-total of child-bearing women. In no condition or stage of life will a woman be less apt to be sent to an asylum by her friends than when pregnant, even though she be very badly insane; and as the insanity which shows itself then is often of a mild type, and even perhaps not always readily demarcated from the moral and other perversions referred to, the reason is still more evident why so few of these cases are reported. This melancholia of pregnancy in a mild form has been observed by me in a number of cases, most of the attacks being transient and recurrent, or, if sustained, of so slight a character as not to excite alarm. I have no doubt that moral causes are the most active of all to induce this condition, and the character of the depression confirms this view. Delusions are not common; in fact, the perceptive and reasoning powers of the patient are but little if at all involved. She is simply depressed and often apprehensive; and, in truth, has sometimes good reason to be so. This apprehension is most often felt in reference to her labor, but not always, for sometimes it is a vague sense of impending danger or trouble which is not formed into ideas or expressed in words. She changes in her affections, or, more properly, she partially loses them. Her husband, children, and household affairs have no longer the same interest for her, and instances are recorded where aversion to the husband takes the place of love. This latter change is probably obscurely related to the sexual instincts and habits, and may be due in part to a sexual relation which is enforced and repugnant. The patient is sometimes only listless and apathetic, at others quite perceptibly and abnormally depressed. In the more severe forms of melancholia, from whatever cause, the countenance is apt to show an expression of great sadness and apathy; the eyes are dull, downcast, or averted; sometimes the attitude also is expressive of dejection, and speech is elicited with difficulty and only on persuasion. I have not seen such grave cases of melancholia occurring in pregnancy, but such are reported. In some cases acute attacks of insanity occur, either of the form called agitated melancholia—in which the patient's depression can no longer be endured, as it were, in silence and dumb show—or of active mania, with delirium and incoherence. This latter form must be very rare, and probably occurs in cases which have a well-marked heredity or in which there may have been a prior attack of insanity. Insane women who become pregnant may, of course—and usually will—continue to show their characteristic symptoms during pregnancy, and without much reference to this state. We have at present in the Philadelphia Hospital such a patient, whom it would be a great mistake to call an example of insanity of pregnancy in any sense. She is simply an hereditary lunatic who very unfortunately conceived a child. The tendency to suicide ought always be suspected in melancholia, whether of pregnancy or not. This impulse has been so often noted in all the insanities connected with childbearing that it may be regarded as very characteristic. I recently saw in the German Hospital, under the care of Dr. John B. Deaver, a woman four months pregnant who attempted suicide by throwing herself from a window, and who broke her collar-bone and suffered a meningeal hemorrhage over the cortical speech-centres, but who did not abort, and who will probably remain suicidal to the end. Primiparæ are supposed to suffer more with melancholia than multiparæ; and the figures given by some observers prove this: it is also in accord with the view of the moral cause in these cases.

The most distinct of all the forms of insanity now under consideration is undoubtedly the mania which comes on within a few weeks after labor. This is the true puerperal mania, which has attracted the most attention, as it is the most frequent and alarming of all these mental disorders. The puerperal patient who becomes the victim of this disease may have exhibited for some time suspicious prodromal symptoms, or the attack may appear quite suddenly. In some cases, perhaps the majority, the period of pregnancy has been marked by some of the peculiarities already referred to, or the patient may even have been noticeably melancholy and changed. These psychoses of pregnancy do not all invariably disappear with the labor, but may be seen occasionally to have constituted a premonitory stage for a more serious alienation. It is not an uncommon observation, in fact, that a melancholic status is the immediate forerunner of an attack of acute mania. In a literal sense, "melancholy is the nurse of frenzy," and appears to characterize that initial period during which the patient has still enough self-consciousness preserved to be aware of impending suffering and illness —something amiss or awry in the mental fabric—before the personality is lost in the agitation and incoherence of the maniacal processes. This precedent stage of depression may be short and may escape the observation of nurse and friends, or it may be noted that the patient becomes fretful and moody, irritable, and apt to find fault easily and unreasonably. She may be absent-minded, changed in her disposition, and begin to exhibit resentment toward her husband and friends or aversion to her newborn babe. She becomes perhaps the creature of uncontrollable impulses: this impulsive nature of her disorder, indeed, is very common and characteristic. Some sudden act of this kind is occasionally the first symptom which abruptly intrudes itself upon the attention of unobservant attendants, and forces upon them the alarming conviction that their patient has become a maniac. One patient of whom I have knowledge threw a heavy glass inkstand at her husband as he entered her bedroom, and with this argument convinced him that she was insane. This is the mental state which leads to sudden suicide or homicide, and which has caused some of the most distressing accidents in the history of insanity The lives of mothers and infants have been sacrificed because this tendency has been unappreciated or ignored. The patient under this impulsive disposition may wander away, making a very sudden disappearance, and may be found, perhaps in a public place at a distance in her night-clothes, it may be with suicidal intent or wandering aimlessly. In the case above referred to the lady, after her disorder was recognized, eluded the vigilance of her keepers and ran a long distance down a country road clad only in a night-dress. Because of the physical conditions attending the puerperium this exposure might be attended with especial danger. An early symptom is sometimes an unnatural gayety and loquacity. The patient laughs immoderately and without cause, and may change quickly to tears in a genuine hysterical transport. She talks incessantly—not exactly incoherently at first, but her ideas succeed each other with unusual rapidity and uncommon powers of expression. A moral shock has been known to precipitate the disease, as the loss of the child, unkind and cruel treatment, or the receipt of bad news, instances of which are recorded. The prodromal period is usually short; and this has been considered by some observers, especially Kraft-Ebing, as quite characteristic of puerperal as distinct from nonpuerperal mania. When the disease is once declared it usually rapidly reaches its acme; thus, the patient in whom nothing wrong was suspected may in a few hours be in a most violent maniacal paroxysm.

The symptoms of mania, as seen in all conditions, are especially exaltation and incoherence. The patient is noisy, restless, possessed of a factitious strength, and exhibits the facial expression of fleeting and alternating emotions. The powers of perception are very much impaired, the memory more or less effaced, and the intellectual processes entirely in disorder. She laughs, talks, combats, and shows a physical activity and endurance which are quite beyond her ordinary powers, and which still further tend to exhaust her. In some the prevailing tone is good-humor, in others there is rage, or these alternate; or perhaps the emotional tinge is not very apparent. The language of the patient is especially indicative of the disorganized state of the mind. Sentences are incomplete and follow each other in no orderly or logical sequence. If attentively observed, these phrases may display fragmentary delusive ideas, but nothing systematized or fixed. The patient's self-consciousness at the worst is quite overwhelmed, and she may recognize few if any of her surroundings and attendants. Confusion of the identity of self and of friends is thus quite common in mania, and has been considered by Tuke, but without apparent reason, to be pathognomonic of the puerperal form. It is certainly common enough in non-puerperal forms. Hallucinations or delusions of the senses are common. These are the false sensorial images of the insane. The patients see things and hear sounds which have no objective reality, but are simply the evidences of disordered subjective processes. Sight and hearing are the senses most affected, although hallucinations of taste, smell, and the tactile sense are not unobserved. These symptoms vary of course in their combinations and intensity in different patients.

In the most delirious forms all sense of personal modesty and decency may be lost, the unfortunate patient exposing her person and passing her dejecta into her bed. Many puerperal patients use very obscene and opprobrious language, and the wonder of horrified relatives is great where and how modest, virtuous, and refined women could ever have learned words and expressions the very sound and utterance of which seem to carry pollution. This tendency has been almost universally regarded as special to and distinctive of puerperal mania; and it has no doubt been so frequently observed that it may always be apprehended. But there does not seem to be sufficient reason to confine this symptom so exclusively. The maniac from whatever cause is not apt to be very choice in his or her language, and, on the other hand, cases of mania following the puerperium do not always exhibit this predilection. Sexual excitement and erotic manners and conduct have also been considered characteristic by some writers, who appear to want to make of this distressing malady something still more sensational and bizarre. That such symptoms occur I am not prepared to deny—on the contrary, it seems probable that obscure forms of irritation of the genitalia may sometimes exist and produce a special train of symptoms—but that masturbation is a common accompaniment of puerperal mania, as some have said, appears to me to be doubtful. The associations of the puerperium may especially direct the patient's disjointed thoughts to sexual and allied subjects, and give to her language a spurious erotic tinge; but self-abuse would not be likely to be excited in such a patient except by some local irritation.

Insomnia is an almost constant symptom. The bodily functions are impaired, the tongue coated and foul, the appetite abolished, and the bowels probably confined. A rise in temperature may occur, and always will in those cases which suffer from septic infection; in fact, a continued rise in temperature ought to put the practitioner in mind of this possible infection, because the probability is great that high temperature in the majority of these cases is caused by sepsis. Clouston's reported cases, already referred to, are very instructive in this connection. In these septic cases other distinct symptoms will be apt to be present. Abdominal pain and swelling, the evidences of a more or less localized peritonitis or of a metritis, may be present. The lochia, in these cases especially, are suppressed or bad-smelling, the tongue brown and dry, and the delirium may be rather of the muttering and typhoid type, varied perhaps with paroxysms of great violence. Two such cases are reported in a preceding part of this paper.

The following typical case of acute puerperal mania was recently examined, and her certificate signed, by me, by invitation of Dr. Chapin of the Pennsylvania Hospital for the Insane: Mrs. ———, aged twenty-two, had had an easy and natural labor with her second child, and appeared well in every respect until two weeks later. At this time she heard of the death of her sister's baby, born about the same time as her own. This event preyed upon her mind. She became depressed, restless, and wakeful at night; she lost her appetite and began to get thin and pale. Two weeks later she began to have paroxysms of excitement with delusions about her nurse and husband, and she imagined that her baby was dead or dying. This condition continued for another two or three weeks, when she suddenly became very much worse. She refused food and became noisy and troublesome in every way. She required to be watched to keep her from escaping from the house, and often had to be held in bed to prevent her injuring herself. For a week before admission to the hospital she had slept scarcely any and had taken little if any nourishment. Upon examination she was found emaciated and anæmic with a brown, dry tongue. She had a fixed, staring gaze, with dilated pupils, and would not respond to questions. She was very restless, throwing off the bedclothing if the nurse turned away a moment, exposing her person and attempting to rise. There was no abdominal soreness, no fever, nor any milk in her breasts. Later she was talkative and incoherent. There was no albumen in her urine. We examined her blood and found the number of corpuscles reduced 20 per cent. No family history of insanity was obtained in this case.

The following case is so illustrative of the causation, symptoms, and lamentable results of this disease that it is presented in full; it occurred in the practice of Dr. E. P. Townsend of Camden, who has narrated it to me: A primipara, aged twenty-one years, was delivered with forceps after a tedious labor, during the early stages of which she had been much excited and very apprehensive, and during the last three hours of which she suffered with a series of eleven severe convulsions. She had had œdematous ankles and feet. She was bled and treated with morphia. The patient continued entirely out of her mind until the ninth day, when she became apparently rational for the first time, but had no memory of the events of her illness. The nurse and mother, contrary to the physician's advice, insisted upon bringing the child into the room, that the patient might see it, at the same time entering into an elaborate explanation of the events of the preceding ten days. They then placed the child in bed alongside of its mother, and in a few minutes both attendants left the room. In an instant the patient seized the infant by the legs and dashed its brains out against the wall. By the time her attendants could return to the room she was again a raving maniac. She recovered after three months. Her physician afterward delivered her of two children without a return of any mental disorder.

The physical condition of women who suffer with insanity during lactation is usually one of exhaustion and anæmia, and the form of mental disease most common among them is melancholia. Of this group of cases perhaps less that is distinctive is observed than in either the pregnant or puerperal cases. The patients are usually from the poorer classes of society, and are mostly multiparæ who have already borne more children than it was good for either themselves or society that they should bear. They are women who have been overworked, and who seem to produce children in an inverse ratio to their pecuniary incomes. Statistics point unerringly to all these facts, and still further indicate the etiology of these mental disorders. More than one-half of Tuke's cases of so-called lactational insanity occurred after nine months of nursing, proving the effect of long-continued lactation. Clouston observed only one-half as many lactational cases among his richer patients as among the poor, while the two classes furnished about equal numbers of puerperal cases.

The depression of mind in these cases corresponds to that which has already been depicted in general terms. It seems, however, that these patients are more apt to have delusional ideas. These delusions are of a depressing kind—the delusions of persecution. They consist of erroneous ideas about relatives, neighbors, and friends, as that these are hostile and say false and slanderous things about the patient. These delusions have some system and consistency, but are not very fixed. They may, however, lead to deplorable actions on the part of the patient, the most common being suicide. Possibly in many cases the symptoms are little more than listlessness, apathy, dejection, and a general sense of personal unworthiness, along with the physical state of anæmia and loss of flesh. The patient under these circumstances will of course neglect her household duties, or rather capitulate to them. In the more advanced cases a decided element of mental weakness is apparent, and is indicated by a loss of power of attention, a disinclination or inability to engage in conversation, and an expressionless face. There is complete loss of spontaneity. Hallucinations may be present in the worst forms of this disease.

All cases of insanity due to prolonged lactation are not, however, melancholia, although I am inclined to think that some of the maniacal cases reported are more correctly agitated melancholia. Still, true cases of mania and delirium, or confusion with mental weakness, no doubt occur during the nursing period. In fact, maniacal excitement may indicate brain-wear and exhaustion just as truly as states of depression indicate them; which still further emphasizes our ignorance of the intimate pathology of these states and of their immediate causation. In cases of acute mania which tend to recovery a period of transient critical weakness or dementia often occurs toward the close of the attack, and is consequently a favorable omen. The patient rallies from this weakness, sometimes quite suddenly and unexpectedly, and is as one emerging from a dream. This has been noted by some, especially in puerperal and allied forms of mania.

Some observers say that they have seen in the puerperal state the beginning of general paralysis of the insane. Kraepelin says that he has twice seen this. It may be a question whether such cases are instances of causes or merely of coincidences. General paresis is comparatively rare in the female sex, and is not as well marked as in the male. Mickle[1] thinks that a suppression of lactation may act as a cause of this disease. He presents a table of 910 cases of dementia paralytica in women, of which 7.5 per cent. are assigned to pregnancy, parturition, and lactation as exciting causes. Of these parturition has 5 per cent. of the 910 cases. I have observed the case of a woman in the Philadelphia Hospital who was admitted when in the sixth month of pregnancy. The attack of insanity began with some grandiose ideas and extravagant conduct. She took $700, which she had saved with difficulty, and squandered it in a few days. She was of a very contented and happy frame of mind, but I have never seen in her the characteristic expansive delusions and boastful demeanor, with alterations of speech, which are so common in male paretics; yet she has some optic atrophy and unequal pupils, and her patellar reflexes are rather lively. Further inquiry revealed the fact that her mental symptoms began some time before her pregnancy; and this is probably the truth with some other cases which are reported as due to the puerperal state.

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[1] *Gen. Par. of the Insane*, 2d ed., Lond., 1886.

Transitory mania or delirium, occurring at the moment of the birth of the child, has been observed not unfrequently, and is described by a number of authors. Marcé has a separate chapter on this subject, and enlarges upon the mental traits, excitement, aversion to husband and child, frantic conduct, and uncontrollable terror and despair, which some women exhibit at the supreme moment of their agony. In some cases, comparatively rare, this excitement has been known to pass into veritable mania. In these cases, as in so many types of alienation, it becomes largely a question of the degree of excitement, of the extent of the departure from the norm of mental equilibrium and control, which will constitute a true psychosis. Obstetricians, especially those who do not make a general practice of resorting to anæsthesia, must frequently see these states of excitement in varying degrees in women who bear pain badly and who may be subjected to prolonged suffering and instrumental interference. I believe it is a mistake to attempt to extend too widely the practical definition and recognized limits of insanity, especially when questions of medical jurisprudence are involved; and I think that a great majority of these cases of very transitory excitement during the second stage of labor cannot consistently be called examples of insanity; and yet the fact remains that an occasional case does happen, and such have been recorded by the most eminent observers, in which the delirium is so acute, the loss of self-consciousness and memory so marked, and the extravagance and desperation of deeds committed are so extraordinary, that the patient must be regarded as temporarily and irresponsibly insane. I have certainly seen cases in obstetric practice, especially in primiparæ, which have approached this degree of impairment, in which the patient, under the influence of intolerable pain, passes quite beyond moral control for the time, uses language and commits minor acts of resentment and wrath toward husband or physician which are quite out of accord with her usual disposition and deportment, changes quite perceptibly in her mental tone, and has very little recollection afterward, in her exhaustion and relaxation, of her unusual behavior. These extravagances of the parturient woman, which sometimes excite a smile in her experienced attendants, may have a deep and painful significance. Under the influence of her travail the patient calls in vain for assistance, attempts to injure herself, tears at her genitals, or expresses aversion to her unborn babe. Cazeau says[1] that this delirium is almost always preceded and accompanied by great loquacity and the pains are hardly felt. He relates the case of a young lady who after rather a lengthy labor attended with extreme suffering suddenly ceased complaining, assumed a smiling expression, and after a few incoherent phrases sang in full voice the grand air of Lucia di Lammermoor. Osiander[1] delivered a woman of twins who was with difficulty restrained by two strong men from throwing herself from a window. He had also seen another woman who demanded that her abdomen be opened, and who had procured a knife for that purpose. He cites the case of a negress, seized by delirium in the midst of a prolonged and painful labor, who opened her abdomen, extracted the child, and recovered. Weill quotes Henke, who saw an access of acute mania come on with the expulsion of the afterbirth, although the preceding labor had been happy. Klug (quoted by Marcé) reports the case of a peasant-woman who in an access of mania accompanying a delivery by the forceps became violent to the point of endeavoring to strangle her child. Helm has reported an access of mania relieved by the rupture of the bag of waters. Kraepelin had under his care a puerpera who threw herself out of a window and through the glass roof of a green-house below.

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[1] *Midwifery*, p. 300.

It thus appears that the subject is fraught with great medico-legal interest, which will be referred to later. It has also some special psychological interest, which is curious if not of much practical importance. Marcé suggests the query, Can a woman in the last stages of her labor be exposed to an access of mania during which she uses violence to her infant, for which she is not responsible, resembling in this those females of certain animals who are sometimes seized during parturition with a fury in which they throw themselves upon their young and bite them to the point of killing them? This suggests the fact that in mental diseases there may be, as some have said, a reversion to the more primitive and instinctive acts which ally the human mind to the instinct of the lower animals. We see in some of these cases a fury which rends the innocent cause of suffering, a perversion at least of the maternal instinct which succumbs to the more dominant instinct of self-preservation, not unlike the Jewish woman of whom Josephus tells us that she devoured her own child during the siege of Jerusalem.

DIAGNOSIS.—Little more can be added to this view of the subject than has already been presented under the etiology and symptoms of these mental disorders. The physical condition of the patient and the physiological processes through which she is passing or has just passed are so unmistakable, and the symptoms of mental disorder as a sequence of this state or of these processes, in part at least, are so apparent, that even the most general rules do not appear necessary to assist the diagnosis. It may be just as well, however, to indicate a few possibilities of mistake which have apparently been made occasionally by observers. The presence of an acute delirious state of mind may be due almost wholly to septic infection, and be a part of the typhoid condition into which a patient may pass. I have seen several of these cases, one of which has been narrated. That patient recovered from her febrile state, but passed into a prolonged insanity; and I think it probable that such may be the history of many of these cases. Still, cases may occur with a tendency and power to recover from a temporary delirium due to septicæmia and exhaustion; and such cases ought of course to be carefully distinguished if possible, and not be hastily judged insane and sent to asylums. If other causes of insanity do not exist, such as heredity and anæmia, and the patient shows a tendency to improve under antiseptic treatment, it is obviously better not to act hastily in certifying the patient to be insane. Any slight delirium or flightiness due to the milk fever alone must be a very rare condition: I do not recall having seen a well-marked instance. It would certainly not be readily miscalled puerperal mania by an intelligent observer.

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[1] Quoted from Jörg.

The occurrence of delirium tremens as an accompaniment of the puerperium presents a subject of some interest and importance in the diagnosis. Copland,[1] I believe, was one of the first to call attention to this subject. He says he had been called to cases which were, in their remote causes and essential features, instances of delirium tremens occurring in the puerperal state. He thinks that the usual tremor of delirium tremens may hardly be observed in some of these cases; hence additional liability to mistake. He attaches much importance to this tremor when present, and says it is to be imputed to alcoholic excess. Fordyce Barker[2] relates the case of a physician's wife who had pelvic peritonitis with rapid pulse and high fever following childbirth, and who acted at the start like a patient with delirium tremens; so much so that her husband had about arrived at this annoying diagnosis. The alcoholic element, however, could be excluded from the case. In women addicted to drink pregnancy may be an additional incentive to it, and the indulgence will of course be likely to be secret; the puerperium brings an enforced abstinence which may then precipitate an attack of real *mania a potu*. The history of these cases would of course be the most valuable aid to diagnosis. I do not know of any particular symptom, not excepting the characteristic tremor, which would be decisive. Time and careful surveillance would probably do much to clear up the nature of the case.

Insane women who become pregnant might be miscalled examples of puerperal insanity or the insanity of pregnancy, but the history of the case in these instances would probably be attainable, and the marks of chronicity in many of them would not escape an experienced eye. Mania as a result of childbirth in cases of illegitimacy, where the labor has been concealed and the infant has been killed or abandoned, has been referred to by some French writers as having occurred, and as being a possibility. In such a doubtful or suspected case the surviving signs of pregnancy, parturition, and lactation would avail, such as the linæ albicantes in primiparæ, the state of the uterus, and the presence of any lochial discharge and distended breasts. No special mental symptoms could be relied upon to establish such a diagnosis.

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[1] *Dict. of Medicine.*

[2] *Op. cit.*

PROGNOSIS.—An old observer of these diseases, who is quoted by Gooch, attempted to establish this aphorism: "The question is not, *Will* the patient recover? but, *When* will she recover?" and yet the patient about whose recovery he spoke thus confidently died within a week. This fairly illustrates the too great confidence which has been sometimes felt by those who have been called upon to treat or examine these mental disorders, and especially the mania of the puerperium. Statistics show that a certain proportion of these cases die or become chronic; and they also seem to show that, of the causes already mentioned, some have a definite preponderance in producing death and others in destroying the patient's mind. Gooch gives expression to an aphorism more exact than the one he quotes. Mania, he says, is more dangerous to life, melancholia to reason. He cautions practitioners to give a guarded prognosis, and reports two fatal cases—one in a few days, in which an autopsy revealed nothing abnormal in the brain or elsewhere. Esquirol gives a favorable prognosis, and says that "more than half" are cured; which might be a very bad result. Of his 92 cases, 55 were cured, but, as Gooch says, these statistics of Esquirol's are misleading, as he had very bad cases only in the Salpetrière. Webster reports 81 cures from among his 131 cases, or 61.83 per cent., and says that the average for twenty years of all females at Bethlem was 53.67 per cent.; but Bethlem Hospital is open to the same criticism as the Salpetrière. Griesinger thinks that the prognosis is favorable, but still the curability has been over-estimated. Schmidt gives the following tables of the duration and results of these various forms of insanity:

DURATION.

Insanity of pregnancy	mania	8.6 months.
	melancholia	9 "
Puerperal insanity	mania	10.3 "
	melancholia	14 "
Insanity of lactation	mania	10.7 "
	melancholia	12 "

RESULTS.

2963 insane females	cured	34.6 per cent.
	improved	12.8 "
	unimproved	40.6 "
	died	11.9 "

283 cases of puerperal and allied insanities .	cured	36.2 per cent.
	improved . . .	19.3 "
	unimproved . .	37. "
	died	7.5 "

RESULTS IN THE THREE GROUPS OF INSANITY.

	Cured.	Improved.	Unimproved.	Died.
Pregnancy . .	35 per cent.	27.4 per cent.	35.3 per cent.	2. per cent.
Puerperium .	53 "	17.8 "	22.6 "	10. "
Lactation . .	25 "	16.4 "	45.6 "	6.3 "

I do not know what value is to be ascribed to these results. The terms used are liable to different interpretations by different observers, and the social and physical conditions of these patients are not clearly indicated. I consider these tables as probably among the least valuable and reliable of all statistics on this general subject. So too of Luebben. He gives the following:

Of 727 cases from various observers, 463 were cured, or 63 73 per cent.
Of 642 cases from various observers, 66 died, or 10.28 per cent.

Tuke says that none of the three forms or groups are very fatal unless complicated with inflammatory processes; and this is a very suggestive and important observation, because the probability is great that septic infection is responsible for many deaths among these cases. Thus, among Clouston's cases all deaths occurred in patients with a temperature over 100°, although all patients with high temperature did not die. He emphasizes the great curability of the disease. Of his 60 cases, 45 recovered = 75 per cent. Most of his recoveries took place quickly: in three months over one half the cases were well.

The influence of inflammatory processes and blood-poisoning in causing death is an important one, and as part of the general subject of septicæmia in the puerperal group of insanities is deserving of especial attention and still further research. McLeod thinks that there is usually in fatal cases some complication, as uterine inflammation and septicæmia. A certain proportion of these cases die also of diseases of the lungs, heart, and kidneys.

PATHOLOGY AND MORBID ANATOMY.—It is not necessary to recapitulate the speculative and fanciful ideas which have been held about the pathology of these groups of mental disorders; some of which have been already stated. Some of the more modern ideas on the same subject appear to me to be equally unfounded, although perhaps not so unreasonable. The custom has been, up to the present time, to deal in very vague and generalized terms, which when analyzed and rigidly examined convey little, if any, accurate information. No one stops to combat the ideas of Hippocrates and Galen, that the vapors ascend from the mammæ to the brain; or those of Puzos, that lacteal deposits are made in that organ and produce madness; or the opinions of a host of antique pathologists, that the lochial discharge is suppressed and excites the brain or stupefies it. But many will read in Morel that "the uterus becomes the seat of an irritation too intense not to react upon all the nervous system," or in Reid and others about the "irritability and excitement of the nervous system," or peruse in various authors statements and descriptions of "irritations" and "reactions" and "alterations," and will not stop to think that these terms, often meaningless in themselves, are at best only the expression of certain facts and not the adequate explanation of disease-processes.

The pathology of simple acute mania and melancholia has not been adequately stated by any one, so far as I know. In fact, I do not understand how the morbid processes of an organ can be described when its normal processes are so complete a mystery as in the case of the brain. The mechanism of thought, the obscure physiological process by which a blood-nourished viscus elaborates consciousness and reason, is absolutely unknown and perhaps unknowable; and the problem is not simplified by discussing its blood-supply, its cell-metamorphosis, its nutrition, its dynamization, its morphology, or its histology. Alterations in these may and do throw some light upon the causation, conditions, and morbid anatomy of mental diseases, but certainly do not explain the intimate pathology of them. The character of the symptoms in cases of mania and melancholia, and the physical antecedents and conditions of many of these patients, indicate that this thought-viscus is profoundly disturbed in its nutrition; but more than this it does not seem possible to say. In the occasional autopsies which have been made in these early and acute forms, the morbid-anatomical state found, or reported to be found, is usually only such as indicates an altered vascular system, such as hyperæmia or paleness of the brain-tissue: in some of these cases, however, observers have been frank enough to say that they have found nothing. Some observers record the evidences of inflammatory processes in the brain or its membranes, but their clinical symptoms do not always accord strictly with these. Reid reports a case of "phrenitis" in which the symptoms were headache, suffusion of the eyes, etc.; only such symptoms as may well attend acute febrile delirium, but without local paralyses, increased tendon reflexes, stiffness of muscles, etc. Inflammation of membranes (and cortex) may exist in some cases, and especially in those which are of septic origin. The evidences of this would be thickened and opaque membranes, a vascular brain-tissue, distended ventricles, and enlarged—perhaps tortuous—blood-vessels. In old or chronic cases of insanity the convolutions may be shrunken, and consequent gaping of the sulci exist, but these things require a nice eye to distinguish. Dr. A. Campbell Clark[1] has made a microscopic study of the brain from a case dying in a typhoid delirious state. He reports extreme vascularity, with tortuous vessels, of pia mater and gray matter, dilatation of perivascular spaces, with perivascular sheaths loaded with small cells, minute extravasations in brain-substance, and the nuclei of the neuroglia exceedingly numerous.

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[1] *Journ. Ment. Sci.*, July, 1887.

Altered states of the blood have a significance in the pathology and morbid anatomy of these diseases. The determination of anæmia is now much assisted by microscopic examination and the counting of blood-corpuscles. Careful examination of the blood by all available methods ought to be made in all acute cases of insanity. Dr. Barton C. Hirst has reported the case of a primipara impregnated two months before marriage who developed hemichorea in the sixth month of pregnancy, and then sank into a state of great mental weakness or fatuity, with irregular pulse, pyelitis, and anæmia. The examination of her blood showed hæmoglobin 40 per cent., corpuscles 3½ millions. The corpuscles, after induced premature labor, sank to 2⅗ millions.

I have started inquiries into the condition of the blood in a number of cases of insanity following labor or occurring during lactation.[1] In the case of a colored woman suffering with melancholia agitata, who had been nursing for six months, and who still had milk in her breasts when admitted into the Philadelphia Hospital, the count gave three and three-quarter millions of corpuscles, with 85 per cent. hæmoglobin: at the end of a month's treatment and feeding, during which her mental and physical condition did not improve, the second count gave the same result. In the case of a young multipara in acute mania, who was emaciated, but whose skin and mucous membranes preserved a good color, the corpuscles numbered about four millions. In a multipara who had borne eight children in twelve years of married life, and who was very thin and in a restless, muttering delirium, the blood-count gave three and three-quarter millions of corpuscles. This was in spite of the fact that this patient had been taking immense quantities of nourishment in the Pennsylvania Hospital for the Insane, where I saw her. In her case, however, there was the suspicion of some tubercular deposit in the lungs.

The complex problems presented by uræmic and septic infections of the blood have not been as yet sufficiently solved, in their relation to the pathology of mental disorders, to make a discussion of them practicable or profitable. That septic infection has an important etiological relation has been already stated and illustrated, but the mode of its operation upon brain-tissue is not understood.

TREATMENT.—The first question of importance which will present itself to physician and friends, especially in acute puerperal mania, is the advisability of removing the patient to an asylum. There are arguments pro and con., and they will weigh differently under different circumstances. The objections to such removal are few and time-honored, but no practical physician but will be obliged to acknowledge their existence and the persistency with which they are enforced. They consist entirely of the fear of the stigma or reputation of having been insane which clings to the asylum case. It is useless to inveigh against the injustice of this as long as the fact remains; and the fact probably will remain as long as the human imagination and understanding continue as they are now constituted. Physicians themselves are not more exempt from this feeling when their own families are invaded than the rest of the community, and all must acknowledge that there are validity and force in the objection. On the other hand, puerperal, like alcoholic, cases, do not suffer as much in this respect as other cases of insanity, as there appears to be a more general common-sense opinion abroad that in mental disorders from these causes the patients suffer only a temporary and curable delirium, due to a cause which is not persistent and which is often under control. This general opinion is no doubt due to the favorable results of treatment in many of these puerperal cases, and is an additional indication of the favorable prognosis which may be usually given in them. Putting aside this popular prejudice, I do not hesitate to say that in the great majority of cases it would be for the patient's good to send her at once to a well-regulated asylum. This is obvious in cases where her means are limited and prevent her from having the seclusion and trained and exclusive treatment at home which her condition so imperatively demands. But even in the case of patients who are affluent the necessity is often not less apparent. The special circumstances attending the maniacal excitement, such as the need of constant watching, the requirements of careful feeding and medication, the control of the extreme agitation and noisy delirium, the prevention of impulsive acts of violence, as suicide or homicide and sudden disappearance, the resistance to the tendency to rapid exhaustion and death or to chronic insanity,—make the case often one of such extreme responsibility and care that it becomes absolutely necessary to consign the patient to the care of those who have special accommodations, attendants, and training for treating these cases. A further and most important advantage of asylum treatment is the isolation, the perfect rest and freedom from the irritation of the domestic environment, the moral effect of a system which works with precision and regularity, without undue coercion and friction, which these institutions afford. Even such an experienced alienist and superintendent as Clouston, however, says that many of these cases can be treated at home, and that it is well so to treat them when possible.

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[1] Drs. W. R. Wilson and W. T. Sharpless of the Philadelphia Hospital have rendered assistance in this work.

I desire to present and emphasize a few special items in the treatment of these disorders, rather than to attempt a general and elaborate scheme of therapeutics, such as is usually the result of a compilation of the various and conflicting opinions of a host of writers. There are some well-recognized principles of hygiene, dietetics, and therapeutics which are more or less applicable to all forms of disease, and these I will not attempt to describe again. But there are a few very important and special requirements in the treatment of the insanities of pregnancy, parturition, and lactation about which I have individual opinions based upon some observation. These may be briefly arranged under the heads of diet and medicines.

The indication given by a large majority of these cases in an impoverished blood-state is to feed. I have no doubt that good feeding, with emancipation from household drudgery and exemption from further conceptions, abortions, and prolonged lactations,would in many of these cases be all the treatment required. I think this is the reason these cases admit usually of such a favorable prognosis, because the anæmic basis of their disorders can be corrected under the attentive and skilful administration of food in good asylums. These are the cases of which Dr. William Hunter speaks when he says, "In general, this species of mania cures itself. I imagine that in all my business I have seen twenty or thirty of these cases, and all of them did well." The kind of food required, it goes without saying, is the simplest, most easily digested, and most nourishing. Milk and eggs, strong broths, succulent vegetables, and tender meats of course make up this ménu. But it is not so much the selection of these articles, which the judgment of the simplest housekeeper could determine, as it is the proper and persistent administration of them. Certain adjuvants to feeding are necessary in many cases. In the more delirious forms the food ought to be given every two or three hours, including the night, and in all forms the daily supply ought to amount to a sum-total which the physiological processes require. A quart to three pints of milk (perhaps artificially digested), with from four to six soft eggs, a day, is the minimum which some would allow: at any rate, it would be safer to err on the side of too much than too little food, as the former error could be recognized and corrected sooner than the latter.

The state of the bowels ought to be carefully watched in the insane, especially in those who require extra feeding. Constipation ought to be corrected, for with it the patient will not eat and digest as she ought. Fresh air not only allows but compels any person to take and assimilate more food than he or she otherwise would do; and this hint ought to be sufficient for those who have the charge of these patients. One of the advantages of hospital treatment is the fact that this demand can usually be met with a care and privacy which are impossible when the patient is kept at home. In very excited and perverted cases forcible feeding by the stomach-tube becomes a painful necessity, but ought never to be attempted without the personal supervision of the physician.[1]

The iron preparations, say Laveran and Teissier,[2] constitute the rational medication for anæmia, but in order to be efficacious need a number of adjuvants. If the anæmic patient is in poor hygienic conditions, if her food is insufficient, if the air which she respires is vitiated, if the light of day and the rays of the sun do not reach her, the ferruginous tonics in all their forms will not cure her anæmia. In a word, iron does not make blood in all its parts. The best preparations of iron, in my experience, for all forms of anæmia, are Blaud's pills (a combination of sulphate of iron and carbonate of potash), and, when the bowels and uterine functions are sluggish, the combination of sulphate of iron and extract of aloes. In inflammatory states of the uterus the latter would be contraindicated. In maniacal and unmanageable cases, in which pills cannot be administered, the best preparation of iron is the tincture of the chloride, or, if this disagrees with the stomach, the powdered carbonate of iron or the ferrum redactum. But iron, it seems, is not always the specific for anæmia. Arsenic of late has many advocates, especially in the more grave forms of pernicious anæmia which sometimes accompany or follow pregnancy. Osler[3] has recently reported a case of profound anæmia following a fourth pregnancy in which the patient could not sit up without fainting, and whose blood gave only 1,170,000 red blood-corpuscles to the cubic mm.; which corpuscles were extremely irregular in size and shape—a characteristic of the corpuscles of anæmia. This patient had received 20 drops of the tinct. fer. chlor. three times a day for nearly two months, but had failed steadily during its administration. Under the use of Fowler's solution of arsenic improvement began at once, and continued until the patient grew large and robust. The administration of the solution of the arsenite of potash was begun in this case in five-minim doses, t. i. d. and increased one drop a day until ten minims were reached. Doses as high as twenty or twenty-five minims t. i. d. are advocated, the gauge being the physiological effects. Osler believes that arsenic is almost a specific in all grave forms of anæmia, and quotes Padley, who collected statistics which show that of 48 cases treated without arsenic, 42 died; of 22 cases treated with arsenic, 16 recovered, 4 died, and 2 improved. I think a combination of these two drugs is serviceable in many forms of anæmia and asthenia.

The use of hypnotic and sedative medicines in insanity calls for the exercise of caution and judgment. When the anæmic and asthenic state of the puerperal and lactational patient is considered, it must be evident that a sustaining, and not a depressing, treatment is the proper one. Such a sustaining treatment has not only a remote, but sometimes an immediate, effect in calming excitement, relieving mental pain, and producing sleep. I believe that in the worst types of these cases, those which have great prostration and depressed nervous and vascular systems, with a dry coated tongue, opiates are not safe or appropriate remedies. The same may be said of chloral in this and all depressed delirious states. I am quite confident that I once saw the heart suddenly stop beating in a patient with delirium tremens from a large dose of chloral hydrate. The only safe rule seems to me to be that where there is a fair state of the vascular and digestive systems, but with great motorial excitement and inability to sleep, as in some forms of mania, or with much psychic pain and consequent agitation and insomnia, as in some forms of melancholia, a single full dose of morphia may be given in the attempt to procure a night's rest, but it ought not to be indiscriminately repeated in a routine treatment by nurses and attendants. This form of melancholia will be more likely to be benefited by this treatment than the maniac, who even after a prolonged morphia sleep is apt to wake up as excited as ever. Hyoscyamine has been tried and approved by some observers, notably by Dr. H. M. Wetherill of the Pennsylvania Hospital for the Insane. In an extensive series of observations of various forms of excitement he was led to believe that the sleep thus obtained was more complete and refreshing, and less attended and followed by inconvenient results, than that obtained from any other drug. The bromide salts are the least objectionable, probably because they are the least efficacious. I do not think they are of much service: they are certainly not good hypnotics. Perhaps they may have some control over cases with great muscular unrest. At the Philadelphia Hospital we have used paraldehyde with some advantage in cases of mania, even of a severe form. This drug, in doses of from one to two drachms, does not appear to be attended with any unpleasant effects. Since the days of Paracelsus camphor has been lauded for its calming action in these disorders, because apparently of its supposed antaphrodisiac qualities; and this is only of service now as showing how extensive the belief has been of sexual perversions in these cases. Different kinds of baths may be important aids to treatment in some of these forms of insanity, but I have had little experience with them. Stimulants may and ought to be given when the pulse is weak and the nutrition feeble. They are to be given for their effect upon the physical rather than the mental state of the patient, if the distinction may be made. In cases with any septic infection the principles of antiseptic obstetrics ought to be most carefully applied. I think enough has been shown in this paper to make the necessity clear for a careful search for this element, and prompt treatment of it when found. The imperative necessity of removing pieces of adherent placenta cannot be emphasized too much. In such a case the interior of the womb ought to be curetted, and irrigated with some antiseptic lotion. I think quinine is of value in those cases of sepsis with a rising temperature, but I do not know that it acts as a specific, as some appear to believe. Bleeding, blisters, and salivation, as recommended by Rush,[1] are mentioned only to be condemned.

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[1] For an interesting discussion of this subject by Drs. Jones, Chapin, Brush, Hall, Mills, Phillips, and Weir Mitchell, see *Proceedings of Philada. Neurolog. Soc.*, March meeting, 1888.

[2] *Op. cit.*, p. 346, vol. i.

[3] *Bost. Med. and Surg. Journ.*

The question of inducing premature labor may arise in some of these cases, especially when the physical condition is bad, as in grave anæmia. In the case of Dr. Hirst, already described, labor was induced because of the debilitated state of the blood and the prostrated mental condition, but the patient was not benefited. I cannot believe that this measure will ever be of advantage, unless it be in these cases of profound anæmia with persistent vomiting. It might be possible thus to avert what threatens to be a fatal issue; and the fact that the patient does not immediately begin to improve in her mental symptoms cannot be quoted against the procedure. In pure psychoses premature labor would not be likely to have any influence in effecting a cure; in fact, the moral effect of the necessary manipulation might be all the more injurious. In cases of delirium and uncontrollable conduct occurring during the close of the second stage of labor, such as have been quoted above, the duty of the physician is to terminate labor with the forceps, under anæsthesia, as soon as possible.

THE INFLUENCE OF PREGNANCY, PARTURITION, AND LACTATION ON INSANITY.

This aspect of our subject is of some interest, and has been thought by a few writers to have practical importance. They suppose that the prognosis of some cases of insanity may be rendered more favorable by one or all of these states. Berger, in his early tract, attributed to abortions a curative value, although the same accident, he says, may also determine an explosion of insanity. Erasmus Darwin[2] advises that the child be brought frequently to the mother and applied to the breast, as this often excites the "storgé," or maternal affection. Esquirol recognizes the fact that these conditions sometimes favorably affect mental diseases, but regards these cases as exceptions, as he had frequently seen insanity persist and even be aggravated by them. Guislain says that pregnancy influences sometimes neither for good nor evil the mental condition of the insane, but that in cases of periodical insanity it can arrest in some cases the development of the mental disease. He knew a patient who was insane almost all the time, but who recovered her reason during the whole of her gestation. Griesinger refers to a similar case of his own in which a mental affection disappeared with each pregnancy. Marcé concludes that childbearing modifies happily certain exceptional cases, and attributes the fact to the reawakening of the maternal instinct by lactation. I have observed a number of cases of pregnancy in insane women. We have several patients now in the Philadelphia Hospital who have been delivered in the insane department. I have not seen any permanent favorable result in any of these cases, unless it was in the following: A young German woman, aged twenty-seven, was admitted in her fourth pregnancy. She had delusions of persecution, and was violent and obscene. She had attacked her mother, threatening to kill her, and had attempted to set fire to the house. She alternated between these sullen and violent spells and periods of quiet good-nature. She was calm and tractable during a slow labor, permitting an examination, although she did talk about choking the doctor. For the first twenty-four hours she allowed the babe to nurse her, but showed no fondness for it. It then became necessary to fasten her in bed, as she insisted upon getting up and would not remain covered. Two weeks after delivery she became more quiet and subdued, and has so remained. This patient had had an alleged sunstroke when fifteen years old: there was an hysterical element in her case, aggravated by abuse from her husband. Two other patients seemed temporarily pleased with their newborn babes, but were very ready to part with them; so that the maternal instinct in these women was at best but feeble and short-lived. If there are any persons who, under the influence of a popular delusion, recommend pregnancy as a cure for insanity, they may reflect that they are not sustained by the great body of recorded facts and the wisest reasoning of experienced alienists on this subject. It is not probable that such a fallacy can be very prevalent at this time. But neither are those better justified, it seems to me, who advise matrimony as a panacea for the neurotic diathesis. Women of this constitution do not bear well the burdens of maternity, and their offspring are not apt to be the most valuable contributions to society.

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[1] Letter to Dr. Spence, replying to one from the latter relating a case of puerperal mania, *Phila. Med. Museum*, 1808, vol. iv. No. 3, p. 129.

[2] *Zoonomia*, vol. iv. p. 70.

The Medico-Legal Aspects of the Insanities of Pregnancy, the Puerperium, and Lactation.

The legal responsibility of pregnant and parturient women in the various psychoses to which they are subject has been, and will continue to be, a nice question of casuistry for the courts. The unfortunate woman who kills her child in an access of acute delirium, and the victim of melancholia who kills herself to escape the burden of her profound psychalgia, do not furnish complex problems to tax the judgment or the charity of mankind: the nature of their cases is usually too evident to admit of a doubt that reason has been dethroned, that the will-power, the self-consciousness, has been weakened or perverted, or the emotions disturbed quite beyond the endurance and equipoise of the mind. But there is a wide range of cases in these two conditions in which the consciousness and reason of the patients are not so overwhelmed as in mania or the emotions so depressed as in melancholia. They are the cases, already referred to, in which the whims, caprices, and morbid dispositions, appetites, and longings of the pregnant woman, or the impulses and frenzies of the parturient one, place these patients on the border-line, as it were, between sanity and insanity, or constitute such a technical and indistinct type of alienation that in the practical demands of medical jurisprudence the opinions of physicians vary, and the jury is apt to decide the case according to their sympathies or the prevailing current of public opinion. Fiction has portrayed these cases, and the public which has wept over the misfortunes of Effie Deans and Hettie Sorel is apt to have a ready sympathy, not inappropriate, for these interesting and appealing women. I think that the psychology of these cases varies, and that the degree of guilt, therefore, cannot be made measurable by any fixed rule. Some women entertain a strong aversion to their unborn babes: these are especially cases of illegitimacy, in which the mother comes to regard the infant as the source, the evidence, and the penalty of her own shame. In some peculiar circumstances this aversion is intensified, and cannot be corrected by any moral appeals. I have seen a striking instance of this. I once had under my care a young woman from a large circle of brothers and sisters, and of a highly respected family, who became pregnant in an amour with a negro servant. She had the most intense disgust for her unborn babe, would not speak of it or prepare for it, and after its birth refused persistently to see it, to nurse it, or to have it brought near her. When we consider the social penalty for such offences we cannot wonder that some of these poor Magdalens, in a frenzy of terror and despair, unattended in the agony of their parturition, uncomforted and unsupported, either abandon their helpless offspring or destroy them in a paroxysm of rage and fear. These cases can scarcely be called instances of delirium, such as happens under the influence of acute pain and great prostration, and which may occur in women who have the happiest domestic and social surroundings; but they are the cases which have oftenest contributed to the annals of medical jurisprudence. Esquirol presents the case of a young woman who becomes illegitimately pregnant, does not conceal it, and makes preparations, is confined during the night, and on the following day is found in her bed and the child in the privy with twenty-one wounds from a pair of scissors. She avows her crime, does not defend herself, manifests no regret, but refuses to eat. Esquirol supposes her to be insane, but I think the mental processes in her case are probably indicated above, and the measure of her guilt must be left to the compromises and sophisms of the courts. Marcé gives a case from the assize court of Marne (1847) of a young woman who had killed her babe by tightening a cord around its neck: she claimed that she was out of her mind, and a compliant jury acquitted her. Boileau de Castlenau[1] gives the case of a young woman who mutilated her infant in a shocking and useless way on the head, back, belly, and limbs, cutting off the head and concealing the bleeding fragments. The jury admitted the extenuating circumstances. This appears to have been simply a desperate and brutal attempt of the patient to conceal her shame. Some years ago a woman named Hester Vaughn was convicted in Philadelphia of infanticide, but public aversion to her execution was so great that the case was compromised and the woman sent to England, whence she had come.

The impulsiveness of the acts of violence which characterizes some of these medico-legal cases has been already referred to. This impulsiveness, however, while in some cases it may be very apparent in the act itself, does not prove that the suggestion of this act may not have lain in the mind for some time, and have been resisted and controlled by the patient until the will-power has suddenly given way before the pressure of a fixed idea. This is of importance in the legal aspect of these cases, because it may possibly be shown, as Taylor suggests,[2] that the patient knew what she was about, and had even requested that the child be taken from her lest she should kill it. This superficial appearance of sanity might have some influence upon the legal mind, and give rise to the specious reasoning that a patient who had such an accurate self-knowledge and prescience could not be irresponsibly insane. Of course such reasoning is false: the morbid impulse, the fixed idea, is in itself one of the symptoms of insanity, which may readily come within the patient's self-consciousness before her mind falls into the confusion of delirium, or even in cases where no well-defined delirium follows; and the subversion of the patient's will-power to such an impulse in the commission of some criminal and unnatural act is only an additional evidence of the extent of her alienation. Morel relates a case of fixed idea produced in a young nursing woman by reading the reports of criminal trials wherein it was said that women were sometimes seized with irresistible impulses to kill their children. She became so filled with this idea that her nursing child had to be taken from her. In those cases in which the impulsive homicidal act has been attempted or committed during the maniacal excitement or just after the cessation of a paroxysm, as in Dr. Townsend's case, already narrated, it is very probable that the deed is in response, sometimes at least, to some such idea which has lain fragmentary or confused in the patient's mind from an earlier period of her malady. Some authors, among them McLeod, say that patients are prone to make unfounded accusations of assault and immorality with much plausibility and circumstantial detail. Rocher refutes Tardieu, who rejects the claim of transitory mania, and Legrand du Saulle, who says the reported cases are allied to epilepsy of a masked type. The latter assumption appears to me to be entirely unfounded. Rocher believes that the causes which produce transitory mania during delivery are shame over an illegitimate birth, heredity, and the nerve-instability of the puerperal state, and in some the extreme pains of labor. Among those who favor the existence of such transitory mania are Morel, Griesinger, and Kraepelin. According to Taylor, irresponsibility on the ground of transitory mania under these circumstances has not been admitted in any English court.

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[1] *An. d'Hyg. pub. et méd. Leg.*, xlv. p. 437.

[2] *Manual of Med. Jurisp.*, edited by Reese, Philada., 1873.

The following case was of some special medico-legal interest; we had the patient in the Philadelphia Hospital at the time, and it thus happened that I was asked to give testimony about her in court: The husband of a Jewish woman asserted that she had always been sane until she sailed for America, and that harsh treatment on shipboard had deprived her of her reason. He claimed damages of the steamship company. The defence proved that she had had an attack of puerperal mania seventeen years before, and had been treated in one of the English county asylums, producing certified copies of the old papers of commitment, certificate, etc. to Cheadle Asylum. The plaintiff's case fell to pieces on this evidence. The woman was markedly chronic in appearance and symptoms, and had evidently never recovered from her primary attack of puerperal insanity.

Some of the most important questions in the medical jurisprudence of the puerperium arise in reference to delusions or alleged delusions of the patient. The fact that some of these patients may make unfounded accusations of immoral conduct has been already stated; but the fact that they may also occasionally make truthful confessions under the influence of emotional excitement and moral stress has not been so generally recognized. The obligation to distinguish these facts is great, and the importance to the patient and her family of doing so cannot be over-estimated. It is very evident that to so distinguish must sometimes be a task of great difficulty. I do not doubt that insane people may sometimes tell unpleasant truths, and that interested friends may find it convenient to have such statements interpreted as delusions. A woman in one of the interior counties of Pennsylvania recently, in puerperal delirium, revealed the fact that she had another husband living. This was apparently not a delusion, as investigation, it is reported, proved the truth of the confession. The most notable of these cases, among all *causes celèbres*, was the Mordaunt case[1] in England. The wife of an English baronet confessed soon after her confinement, and in the commencement of what appears to have been an attack of puerperal insanity, that she had been an unfaithful wife and that the child was not her husband's. She implicated a number of men well known in the social world. A trial resulted, which is unsurpassed in the unsavory scandal and serious consequences which arose from it. The collateral evidence, which confirmed the patient's statements and compromised her still more, does not appear to have been refuted, while, on the other hand, the testimony of some of the most eminent alienists and practitioners leaves no doubt that after her confession the patient sank into a state of insanity. The conclusion seems inevitable that the woman made a truthful confession in the initial stages of an attack of insanity.

The morbid cravings and desires of pregnant women have contributed something to the annals of legal medicine. Rocher speaks of the connection of "kleptomania" and pregnancy. He says medical jurists are sometimes called upon to pronounce upon such cases, and refers to Marc, who has some reflections on this subject and this proposition: "Can a woman imprisoned for stealing give as an excuse a longing of pregnancy?" The terms "kleptomania" and "pyromania," as applied to special so-called forms of insanity, are very artificial and inexact: it is true, however, that they indicate some special features and tendencies of a class of psychoses which are closely allied to monomania. These tendencies may show themselves in pregnant women, especially in those with an hereditary predisposition to insanity. The following case from Casper[2] illustrates this subject and may close this discussion: He relates an instance of theft alleged to be produced by the longing of a pregnant woman. He admits that it was unquestionable, and determined that the patient during her pregnancy had a longing for bright objects. In this state she stole some small objects from the jewellers' shops. She had exhibited a remarkable alteration in her mind soon after the commencement of her pregnancy, which was her first. She was absent and forgetful. She had taken bright objects from her friends, who recognized that it was the result of her condition and had treated it as an idiosyncrasy and indulged it accordingly. Her mind was obscured by her pregnant state. In spite of these acknowledged facts, Casper says that the conclusion was reached that the alleged longing was not irresistible, because the patient recognized and had tried sometimes to combat it—that she had lied about it, and that therefore it had not morbidly impelled her to commit these thefts; therefore she must be regarded as a responsible agent. The results were the punishment of the lady, her divorce, and after a lapse of years, and at a time when she was not pregnant, another theft of a piece of silk. It is thus criminals are made. Comments are unnecessary.

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[1] *Official Report*, Mordaunt *v.* Mordaunt.

[2] *Handbook of Forensic Medicine*, vol. iv. p. 308.

II. OCCASIONAL NEUROSES OF PREGNANCY AND THE PUERPERIUM.—CEREBRAL EMBOLISM AND HEMORRHAGE.

THE childbearing woman is subject to a variety of lesions of the cerebro-spinal system, besides the psychoses already described in the preceding paper, which merit separate and distinct mention in the present system. Prominent among these are chorea, eclampsia, rarely tetanus, and hemorrhage and embolus of the cerebral vessels. Epilepsy is an occasional coincident. Eclampsia has been described by another contributor. The others will be briefly reviewed, with some original observations, in the present paper.

THE CHOREA OF PREGNANCY.

DEFINITION.—The disease about to be described is usually a severe form of chorea occurring in pregnant women. In its clinical form it has no special characteristics to distinguish it from the simple, idiopathic chorea of childhood and early adolescence, but it presents some special features in its etiology, the severity of its type, the gravity of its prognosis, and the vexed questions of its treatment. It is therefore deserving of distinct consideration in a system devoted to a complete science and art of obstetrics. It cannot, however, be studied with profit apart from the general subject of chorea as observed in all other conditions, because it is doubtless intimately associated with that in its causation and pathology, while, as before intimated, it is practically identical with it in its symptomatology. The term "chorea" has been variously applied by writers, since it is one of those unfortunate words in nosology which do not represent a definite and recognizable disease-process. It is well, therefore, to define it at once as used in this connection. Chorea is a disease of the motor or neuro-muscular system, characterized by a series of involuntary, inco-ordinate movements of the face, tongue, neck, trunk, and extremities, very little under control of the patient's will, often made worse by voluntary efforts, persisting during waking hours, usually ceasing during sleep, and associated with or followed at times by more or less loss of power in the affected muscles, and, in severe cases, with a relative prostration of strength and feebleness or affection of the mind. This disease has no necessary connection with the so-called "chorea major," which is a term applied to a group of nondescript convulsive and acquired movements of endless variety usually observed in hysterical subjects or those under some special exciting influence, as religious revivals, endemic and imitative impulses, etc., and which are often distinctly rhythmical and purposive, or of the nature of an acquired, artificial, or automatic trick or dexterity.[1] Some forms of involuntary or myoclonic shocks, not properly choreic, are described, as well as the convulsive tics, which are not inco-ordinate; but none of these rather rare forms are apt to be associated with pregnancy.

It is not desirable, in this connection, to attempt a history of the true chorea. Sydenham gave a brief but admirable description of it, and subsequent writers finally differentiated it from the many indefinite and acquired disorders already referred to. Its place is fixed: only its pathology claims the interest of the school now in vogue.

CAUSES.—The meanings attached to this term by different writers are so variable that it is somewhat difficult to select that one condition or phenomenon in the successive links of cause and effect which will be most acceptable as the most common and universal. Thus, it has been customary to say that rheumatism is a cause of chorea: and there can be no doubt that it is a frequent antecedent and an occasional coincident of the disease. But we know that no very definite idea can be attached to the word "rheumatism" as indicating a disease-cause or essence, although certain inflammatory states of serous membranes are easily recognized which are called rheumatic. Hence it appears that really one of these inflamed membranes—the endocardium—is supposed to be the cause of chorea by reason of the emboli which are washed off from it and carried to the capillary system in the brain. As this is properly a question in pathology, it is discussed under that head. This embolic theory, however, does not satisfactorily explain all cases of chorea, because very many patients with chorea have never had rheumatism; therefore, some have supposed that the exanthemata may cause the endocarditis, and thus they still attempt to hold to this theory. Again, this obscure and unknown disease-poison, rheumatism, is said to be the common immediate cause of both the endocardial changes *and* the chorea, but how it acts is not explained. In the report of the collective investigation committee of the British Medical

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[1] For a discussion of the varieties and diagnosis of chorea see Guinon, *Gaz. des Hôpitaux*, 1887.

Association only about 25 per cent. of cases of chorea had had undoubted rheumatism. I have no statistics, but it has been the commonest thing in my observation to find no evidence or history of rheumatism.

Certain peripheral irritations have been looked upon as causes of chorea, prominent among them being pregnancy and intestinal worms; so also a tight prepuce, and again insufficiency of some ocular muscles. Pregnancy no doubt acts as an exciting cause: this is its true relation to the disease as we are now considering it, but *how* it acts must remain a mystery for the present at least. It is quite impossible to give statistics showing the relative frequency of this cause. To do this it would be necessary to know the number of cases of chorea happening in the total number of pregnancies and the number of cases of pregnancy happening in the total number of choreas. Such figures are not forthcoming. The association of rheumatism and pregnancy as conjoint causes of chorea seems to be indicated by the fact that a certain number of cases exhibit both these etiological factors.

Emotional disturbance or shock has been supposed to be an exciting cause. In some of these cases, happening during pregnancy, this etiology has been strikingly indicated: several such cases are referred to in this paper. In the simple chorea of childhood this element seems to have been present sometimes.

Previous attacks of chorea during childhood in persons who afterward develop the disease in pregnancy are recorded in some cases. In such cases a predisposition to the disease appears to have existed which required only an exciting cause.

It thus appears, with our present knowledge, that the true causation of chorea, especially in pregnancy, cannot be definitely stated. We can recognize certain antecedents, as rheumatism, shock, and pregnancy, but how such diverse causes can act to produce such a characteristic and always distinct disease has nowhere by any person been satisfactorily explained.

SYMPTOMS.—The description which Sydenham gives of the choreic patient is unsurpassed, as far as it goes, by the more elaborate efforts of modern authors: "This disorder is a kind of convulsion, which chiefly attacks children of both sexes, from ten to fourteen years of age. It first shows itself by a certain lameness, or rather unsteadiness of one leg, which the patient draws after him like an ideot, and afterwards affects the hand of the same side, which, being brought to the breast, or any other part, cannot be held in the same posture a moment, but it is distorted, or snatched by a kind of convulsion into a different posture and place, notwithstanding all his efforts to the contrary. If a glass of liquor be put into his hand to drink, he uses a thousand odd gestures before he can get it to his mouth; for not being able to carry it in a straight line thereto, because his hand is drawn different ways by the convulsion, as soon as it has happily reached his lips, he throws it suddenly into his mouth, and drinks it very hastily, as if he only meant to divert the spectators."[1] In this brief and concise sketch the author not only happily describes and illustrates the convulsive movement, but also distinctly indicates that the affection is often unilateral—a fact which, as will be seen, has been much relied upon by some recent pathologists to sustain their particular views of the nature of the disease. Chorea, then, as seen under all circumstances, is a disease marked by irregular, involuntary, clonic spasms of individual muscles, or more often physiological groups of muscles, sometimes general, but frequently most apparent on one side, or occasionally more noticeable in the arms than in the legs. The irregular and inco-ordinate character of these spasms is one of their distinctive marks. They do not follow each other in any regular order or sequence of time or location, one group of muscles throwing the limb first in one direction and then another group quickly jerking it in another. While this is in the main true, I think I have been able to note on close observation that there is some similarity in the repeated movements if watched for some length of time. The fact that the affected muscles are often those which are constantly associated in complex physiological processes gives to these movements sometimes a partial resemblance to voluntary or purposive acts awkwardly performed; and the real voluntary acts performed by the patient are much embarrassed by the increased choreic movements excited by the volition. In long-standing cases, however, some patients seem to gain a certain dexterity in eluding, as it were, rather than controlling, the irregular spasms, and thus may be able to do some things requiring precision of movement. The range of the movements is wide, thus differing from the small, fine action of a tremor or the weak, sluggish motion of a fibrillary contraction. They have no rhythm, thus differing very notably from the constant and regular movement of paralysis agitans. These spasms, again, are constant during waking hours, and are entirely independent of volition; that is, they continue while the patient is making no exercise of will-power. This is an important clinical distinction, because it helps to differentiate chorea from the irregular, atonic movements of disseminated sclerosis of the cerebrospinal axis, which movements are observed on volition only; and this distinction may have pathological significance, which, however, we are not yet able to interpret. It is commonly observed that chorea is often confined to, or more marked on, one side; occasionally one limb or the muscles of the face and eyebrows are most involved. I am sure that I have seen it most marked in the arms, face, and trunk in cases in which the legs were only slightly affected. Thus, in a case of long standing which I recently specially observed in reference to this fact the arms were constantly jerked about, the forearm alternately pronated and supinated, the fingers moved somewhat as in athetosis, the face worked, the eyes opened and shut, the tongue protruded in choreic jerks, and the body twisted about on the chair with a squirming motion; and yet the legs were but little affected, but they were not exempt.

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[1] The entire *Works*, etc., London, 1763: "Schedula Monitoria," etc., p. 552.

The sensory symptoms in chorea are often not at all marked: the disease, as has been said, is one of the motor side of the nervous system, and hence the sensory symptoms which occur are only those which are secondary to the violent agitation and unrest of the muscles. Thus, there are occasionally pain and aching in the limbs, and a general sense of soreness and weariness, which are evidently caused by the constant involuntary movements. Anæsthesia and altered states of sensation are not observed, or, at least, not generally. Some observers, I believe, have found some patches of anæsthesia; but when the difficulty of making satisfactory tests in these cases is considered, as well as the fact that the results must be taken from the observation of the patients themselves, many of whom are certainly not in a mental or motor state favorable to exact observation, these results may be regarded as questionable at least.

The nutrition of the choreic patient under all circumstances and from whatever causes is apt to be impaired. Anæmia is very commonly observed, with an attendant loss of weight. In the cases occurring in pregnant women this altered state of the blood is especially found. The tendency to anæmia in pregnancy under some circumstances is a topic of great interest and importance, and has been already referred to at some length in the preceding paper on "Puerperal Insanity." In all the cases of chorea happening during pregnancy which I have seen the anæmia has always been evident, as well as loss of flesh and a general—sometimes rapid—prostration of strength.

The violence and range of the movements vary in different cases, but the type of the cases occurring during pregnancy is apt to be severe; in fact, the most severe cases of chorea observed appear to have been those of pregnant women. In a very large number of cases of chorea observed by me I have never seen any to compare in violence and extravagance of movement with two cases—one of a man with hereditary chorea, and the second of a woman with chorea in the fourth month of pregnancy. In some instances the poor victim of this strange malady cannot be restrained in bed as she throws herself about in the contortions and convulsions over which she can exert no effectual control. In these extreme cases sleep, as well as nutrition, is much interfered with, and the urgent demand and desire for this add much to the patient's distress. Appetite, with the ability to assimilate food, is of course impaired. The action of the heart may be disordered: in the first place, in cases with a rheumatic history, the heart-valves may be damaged, and again, in cases which present no organic valvular disease, some observers claim to have found a genuine choreic irregularity in the action of the heart-muscle. The latter alleged fact is doubtful, but it is true that the heart's action in many cases is weak and rapid.

The tendency to abortion and premature labor in the chorea of pregnancy must never be lost sight of. Statistics and the reports of individual observers show that this tendency is quite marked. Some writers have indulged in speculations as to the cause of this; but certainly any one who has had the opportunity, and has attentively observed a case of severe chorea in a pregnant woman, has not far to go to find an explanation. The wonder rather is that all these women do not abort, and abort quickly—that the gravid uterus can continue for even the shortest time to retain its contents amidst the general motor disorder. In these severe cases not only the limbs, but the muscles of the trunk—both back and abdomen—are in constant, irregular, and violent action, the latter exerting compression upon, and dealing blows and shocks to, the enlarged womb. In addition, the patient is in a more or less prostrated physical state, taking insufficient nourishment, and hence starving the fœtus. In these facts, then, appear very evident reasons why, after a while, in many cases the womb gives way and abortion occurs. The duration of the symptoms is not always coincident with the pregnancy. In some cases the disease has been controlled or has ceased before term, while in other cases the symptoms have persisted for shorter or longer periods after labor. A very few cases of chorea have been reported which did not make their appearance until after confinement. In the largest number of cases the initial symptoms are observed in the first half of pregnancy.

Motor weakness, even to the extent of paralysis, sometimes accompanies or follows chorea. It is especially observed in the cases of unilateral or hemichorea, probably because in these cases the paresis is more marked in contrast with the sound side. Recovery from it usually occurs soon after the cessation of the abnormal movements. Some pathologists, who believe that chorea is caused by minute emboli in the capillaries of the central nervous system, cite this paresis as additional evidence of such organic changes: on the other hand, it has been regarded as merely an exhausted state of the muscles caused by their over-action.

In a case which I once attended the patient not only had an extreme anæmia and prostration, but suffered with an extensive and obstinate abscess of the mammary gland. I have not seen this mentioned as a complication in any reported cases, although two of Ogle's[1] fatal cases had abscesses in other parts of the body. The patient was a young primipara, suspected to be illegitimately pregnant, although this was denied; at any rate, she was not living with her husband. There was also reason to suspect syphilitic infection. Her chorea began in about the third month of pregnancy, and was very severe. At its height the girl was kept in bed with difficulty. The movements were general, the muscles of the face, tongue, neck, trunk, and limbs being actively convulsed. Her speech was so affected that it was sometimes difficult to understand her. Her mind was evidently weakened and changed, although she did not show any delusional or maniacal states. When her disease had continued for several weeks, she complained of pain in the left breast, which was found swollen and inflamed, just as is observed sometimes after labor. There had been no previous signs of milk in her breast, nor was any found then or subsequently in either the inflamed or sound gland. The inflammation went on to active suppuration, which required a number of incisions for the evacuation of the pus. The sinuses formed were not easily healed, the matter was thin in appearance, and the general aspect of the inflammation was not very healthy. The question arose at the time whether this abscess was the effect of some traumatism self-inflicted by the patient in her numerous involuntary and uncontrollable movements; and I believe that this is the correct explanation of its origin, while its special features may be accounted for by the patient's debilitated condition.

Dr. William Goodell has recorded[2] a fatal case of chorea happening in his own practice which had some special and remarkable symptoms. This patient also was a young primipara illegitimately pregnant, although married during her early pregnancy. She had a history of several previous attacks of chorea during childhood, one following scarlet fever, another following rheumatism, and a third being caused by the shock of her father's sudden death. The initial symptoms of her last chorea began at quickening, and were unilateral, but the movements subsequently became general. Premature labor at the eighth month came on. It required the united aid of three persons to permit the physician to make a vaginal examination, and the choreic movements were so violent that all these attendants could not keep the patient on the bed, so that it became necessary to spread blankets on the floor and to deliver her on these. She had a series of the most wonderful muscular movements—now nearly striking the nape of her neck with her heels, now almost hitting her chin with her toes, at the same time throwing her arms about in every conceivable manner, and rapidly protruding and withdrawing her tongue, which, however, she never bit. In a position of rigid opisthotonos she would roll over sideways or diagonally, sometimes making complete somersaults, dashing her head, her arms, her legs, first on one wall and then on the other of the narrow room. During this time she never spoke, but at long intervals uttered a wild scream; yet intelligence was not wanting, for she kept her eyes constantly fixed on her physician, as if imploring rescue from the clutches of some invisible demon. Ether, chloral, and the bromides had but little effect to control the movements: chloroform did better, aided by morphia under the skin. After labor the frightful contortions returned: the pins of the binder were torn out, and, although the hemorrhage was not excessive, she soon managed to smear with blood her person, her bed and bed-clothes, and the wall to a height of three feet. This patient lingered two days, and died of exhaustion, the choreic movements not ceasing until they were lost in the coma preceding dissolution. This case illustrates the fact that some of these patients are old choreic cases, who have suffered with the disease during childhood or in previous pregnancies, and that pregnancy is only one of a number of exciting or predisposing causes. These facts seem to disprove the theories which attribute chorea to some one special pathological state, such as capillary embolism following rheumatic endocarditis.

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[1] *B. and F. Med.-Chir. Rev.*, vol. xli., 1868.

[2] *Am. Journ. Obstet.*, vol. iii. p. 140.

In some cases the choreic movements have been comparatively slight until labor set in, when they have become suddenly much worse, the patients dying of exhaustion.

The urine in chorea is said to be always dense with urates and phosphates, and the presence of these salts is explained by the great waste of muscular and nervous tissue accompanying this disease. Retention and incontinence of urine are mentioned by a very few observers[1] as having occurred in some cases. Incontinence has been known, so it is said, to interchange with chorea of the external muscles.

Some observers have thought that a connection exists at times between chorea and other neuroses, and that the symptoms of these latter may accompany or complicate the former. The diseases especially mentioned are hysteria, epilepsy, paralysis agitans, and paralysis. It is undoubted that choreic patients exhibit frequent emotional disturbances which may be regarded as hysteroidal, but these are probably the natural effects of the tormenting disease from which they suffer. Genuine epilepsy as a result or complication of chorea has never been observed by me, and I cannot recall a well-authenticated case on record: so, too, of paralysis agitans, which, however, while perfectly distinct in the character of its movement and its clinical history, might be confounded by a careless or inexperienced observer with some form of chorea. Paralysis, in varying degrees, is an undoubted accompaniment or sequela of chorea: whether directly caused by the same lesion of the central nervous system or simply by the over-action of the convulsed muscles is an open question.

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[1] See Ogle: *op. cit.*

The mental health of the choreic patient is not unusually affected. This aspect of the subject has both clinical and pathological interest: it can scarcely fail to attract the attention of observers, and so to constitute an important and characteristic symptom-group, while it has been especially appealed to by some pathologists to support their views of the morbid process occurring in this disease. The special alteration which I have observed in chorea is a certain weakness, fatuity, or absence of mind, which is but slight in the majority of cases, and which is probably a secondary effect of the peculiarly harassing and absorbing nature of the symptoms. A child or a woman who is depressed in health, anæmic, the result of anorexia and insomnia, and the victim of a ceaseless and annoying malady, which distracts the attention from everything profitable and concentrates it upon the immediate discomforts of the hour—who is, moreover, a conspicuous object of curiosity or amusement to every idle observer—naturally becomes somewhat changed in character, shy and depressed, listless, or even weakened in the exercise of the true cerebral functions. This, then, has been the state most frequently observed, and which Sydenham refers to as that of an "ideot." This state, however, may be erroneously attributed to some cases, and for the following reason: the constant jactitation of the patient, with the grotesque gestures and odd and foolish grimaces, simulating purposive acts, gives to the countenance and general deportment an appearance of weakness and imbecility which is superficial and misleading. It may therefore be unjust to ascribe to these involuntary movements the actual significance which they would have in health. In some cases I have seen the countenances of the victims haggard and downcast, and in very many of them wearing this semblance of mental prostration.

More serious psychoses, however, are occasionally observed, although they appear to be rare. In the report of the collective investigation committee of the British Medical Association 439 cases of chorea are analyzed, and of this number 3 were complicated with hysteria, 2 with emotional disturbance, 1 with ungovernable temper, and 1 with delirium. These cases were not necessarily associated with pregnancy, as the list includes chorea from all causes. Active mania has been seen in grave choreic cases as well as states with hallucinations. As the chorea of pregnancy is of a severe kind, it is probable that some of these grave mental affections may occur in this class of cases with more relative frequency than in simple cases. Schuchardt[1] has recently given some illustrative cases of the connection of chorea and mental symptoms. In one the choreic and mental symptoms were the combined product of lead-poisoning; in others the following symptoms were present: idiopathic chorea, followed by a change of character, mania, and hallucinations, terminating in dementia. Marcé has written[1] a careful analytical paper on this aspect of our subject founded upon the observation of 57 cases of all ages and both sexes, and draws the following conclusions: Two-thirds of the cases had affections of the intellectual and moral faculties; these alterations are four: (1) change of character, irritability, and an unusual tendency to gayety or sadness; (2) affection of the intelligence characterized by loss of memory, instability of ideas, and impossibility of fixing the attention; (3) hallucinations, coming on especially in the evening in the intermediate state between waking and sleep, affecting especially the sense of sight, and associated particularly with hysteroidal symptoms; (4) maniacal delirium, a very grave complication, which may end in death, or in other cases may leave after it divers mental troubles of variable duration. Some of the mental complications recorded in the books have probably been observed in cases of the so-called "chorea major" rather than in true chorea: these are especially hysterical, automatic, and imitative phenomena. The following case is one of special interest: it has been observed by me in the Pennsylvania Hospital for the Insane, under the care of Dr. John B. Chapin: Mrs. ——, aged 25, was admitted five weeks after the first symptoms of insanity appeared. Prior to her marriage, about six years before, the patient was known to be hysterical, with exacerbations of excitement at the approach of and during the menstrual periods. After her marriage this condition increased, and especially after the birth of her two children. Chorea developed soon after the birth of her first child, five years before the insanity, and has continued steadily to advance. The first symptom of insanity was observed when she discovered that she was taking arsenic for her chorea: she immediately conceived the delusion that her husband was trying to poison her, and she has continued since to refuse all medicines. Other delusions followed, as that her children have been murdered by their father, although she occasionally sees the children alive and well. She has a sense of fear and apprehension of personal danger from her husband. She is in part demented; her memory is impaired, she is confused and silly, laughs impulsively, hysterically, and without cause, and sheds tears. She has sometimes refused to take food, under the impression that her husband poisons it. Upon admission she required to be assisted from the carriage into the house by two persons, one supporting her on either side, her limbs jerking about so much that locomotion was almost impossible. At present her articulation is much impaired, as well as her writing, the pencil staggering about and finally flying from her grasp. The entire muscular system of the head, neck, trunk, and limbs is contorted by a series of jerking movements quite beyond her control. Occasionally, as she lies in bed, a wave of convulsive movement passes through the entire system. The heart's action is rendered quick and irregular in force and rhythm by the least effort or excitement. The tongue is protruded with a jerk, and is in constant irregular movement. The limbs twitch about when she is asleep.

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[1] *Allg. Zeit. f. Psych.*, 1887.

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[1] "De l'État Ment. dans la Chorée," *Mém. l'Acad. Imp. Méd.*, tom. xxiv.

PATHOLOGY.—An attempt to review and criticise all the various speculations which have passed for knowledge of this subject is quite impossible within the scope of this article. None of these have contributed much definite and practical information, unless it has been to indicate an etiological relation, not thoroughly understood, of rheumatism and some of the eruptive fevers to chorea. It is not necessary to allude to the vague and inexact language in which it was formerly so often the custom to convey opinions about the pathology of all nervous diseases. These, and chorea among them, were said to be due to "irritability" or "depression" or "reflex action" according as the individual fancy or the prevailing fashion dictated. Such terms convey no complete and definite ideas. Prominent among all the theories which have been advanced to explain the cause and disease-process of chorea is the one which ascribes it to rheumatic inflammation of the valves of the heart acting by minute emboli, which, becoming detached, are conveyed by the blood-current to the capillary system in the brain. Copland[1] claimed to be the first to point out this relation, although he did not originate the embolic theory. He says that the complication of chorea with rheumatism, rheumatic pericarditis, and disease of the membranes of the spine was first demonstrated by him in a post-mortem examination which he published. Bright, according to Tuckwell, attempted to explain this relation by supposing that the pericarditis propagated an irritation along the phrenic nerve to the spinal cord, from which it was violently reflected along the motor nerves to the muscles of the body. Later, most writers appear to have been satisfied with saying that the chorea, the heart complications, and the mental changes were due to one common cause, rheumatism, until it appeared incontestable, after numerous clinical observations, that very many of these choreic cases had no antecedent history of rheumatism whatever. This difficulty was in a manner surmounted by Kirkes,[2] who published two papers in 1863, in which he repeats what he says he claimed in 1850—his belief in the relation of inflammation of the cardiac *valves* to chorea, which is founded on the facts that a murmur exists frequently, if not *invariably*, in chorea, and that fatal cases of the disease present post-mortem evidence of inflammation of the valves or the left side of the heart. He gives the details of a fatal case of chorea in a pregnant woman in which the autopsy revealed minute vegetations on the valves of the heart as well as small capillary engorgements in the central nervous system. This appears to have been the début of the embolic theory; and Dr. Kirkes is to be credited with having been the first to indicate that chorea "was the result of irritation produced in the nerve-centres by fine molecular particles of fibrin which are set free from an inflamed endocardium and washed by the blood-current into the capillaries of those centres."[1] In 1867, Tuckwell,[2] influenced by these views, put on record an important case of chorea, with mania followed by death, in a boy. This autopsy was one of the earliest of those which have been made with sufficient care to entitle them to consideration. He found numerous bright, warty vegetations along the free margins of the mitral valve. In the brain small areas of red softening were observed in the cortex of the frontal and also of the "posterior" lobe, and into one of these an arterial twig, firmly occluded with a small white fibrinous plug, was seen to run. In the spinal cord softening was found in the posterior columns of the lower cervical and all the dorsal region, and one of the blood-vessels of this part was affected as in the brain. Ogle[3] published a paper giving details of 16 fatal cases of chorea, of which 10 cases presented more or less fibrinous deposits or granulations upon some portions of the heart's valves or lining membrane. Broadbent[4] elaborated the embolic theory to some length: Chorea, he says, is a symptom and not a disease; *i. e.* it depends upon the *seat* of the morbid process rather than upon any *one* distinct morbid process. This seat is the sensori-motor apparatus, the thalamus and corpus striatum. The cerebral hemispheres are not primarily involved, as the mind is not affected except secondarily; neither can the symptoms be attributed to the cord, to which can only be assigned tonic spasms, uncontrolled by the will, increased during sleep, and especially not unilateral. He thinks the emboli are not confined to the thalamus and corpus striatum, but that it excites chorea in them, delirium in the brain-cortex, and tetanus in the cord; hence, chorea is an "insanity of the muscles" or a "delirium of the sensori-motor ganglia." He thinks that emboli are the frequent, but not the invariable, cause of chorea, which may be caused by shock also and by pregnancy, intestinal worms, etc. Hughlings Jackson has especially identified his name with the embolic theory. He speaks of puerperal mania as a "chorea of the mind," and thinks it may be due to the same pathology (embolus) as that which causes chorea, but in a different part of the brain. He meets the objection that plugging of a vessel could not cause increased action, as follows: Plugging does not always cause *anæmia*, but sometimes a congestion which may be due to increased pressure on the collateral vessels or by a return of blood from the veins. Hence the action of the parts is not necessarily *decreased*, but is defective.[1]

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[1] *Dictionary*, art. "Chorea."

[2] *Med. Times and Gaz.*, 1863, pp. 636 and 662.

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[1] Tuckwell: "Maniacal Chorea," *B. and F. Med.-Chir. Rev.*, Oct., 1867.

[2] *Ibid.*

[3] *B. and F. Med.-Chir. Rev.*, Jan., 1868.

[4] *Brit. Med. Journ.*, April 17, 1869.

I have referred in some detail to this embolic theory of chorea, because it has become historic as the only plausible theory which pathology has had to offer to explain this important disease; because, also, of the eminent names which have been associated with it; and finally, because, while much overrated in the past, it may contain some elements of truth as a contribution to the future. Like so many other theories springing up from a too exclusive pathological or post-mortem view of disease, it may in part substitute effects for causes, and find in a few mere necroscopic phenomena an erroneous interpretation of the essential nature of disease. That it does not and cannot explain many of the facts of chorea has been very generally maintained. This is not more conclusively shown anywhere than in these very cases of chorea occurring in pregnant women. Those who have observed such cases, and have studied the reports of cases by others, must be impressed with the fact that some special features exist in them which can only depend upon something special, but unknown, in their causation and their pathology. The large proportion of them occurring, for instance, in young primiparæ, and, again, in women illegitimately pregnant, suggests at once a moral influence; which confirms the oft-observed fact that simple chorea is caused also by moral changes, as shocks, fright, etc. The extraordinary severity of the symptoms, unequalled by all other cases of the disease, suggests, at least, that if they have a common cause with simple idiopathic chorea, that cause is certainly strangely intensified by some special conditions which would be sought for in vain in the capillary system. The fatal termination of such a large proportion of these cases—out of proportion, I believe, to the deaths in simple chorea—is difficult to explain by the theory of emboli, although not necessarily antagonistic to that theory. The fact that pregnancy is so specially obnoxious to this disease seems to preclude the necessity of searching in some other condition, such as rheumatism, for a cause, especially as so many cases of chorea have occurred in pregnant women who have never had rheumatism and who present no cardiac lesions. To say that all cases which do not support a given theory have been improperly observed and reported is only to beg the question, and is certainly no more justifiable than, if indeed it is as reasonable as, the assertion of some that the occurrence of these very minute vegetations on the valves of the heart is an event which happens about the time of the death of the patient, as is evidenced by the fact that they can be displaced by the stroke of a soft camel's-hair brush. Certainly, it would not be proper to ignore the relation of rheumatism, and especially of endocardial changes, to chorea; but it would be unwise to ascribe too exclusively to such changes a disease which shows itself so frequently in other conditions, and in none more significantly than in pregnancy. As for the many other post-mortem appearances reported, such as hyperæmia and microscopic changes of degeneration of the multipolar and other cells, it can only be said that such have been reported for almost every nervous disease known, and that they are probably either effects or coincidents of the disease in question, and not characteristic of its cause.

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[1] *Med. Times and Gaz.*, 1869, i. 245.

Rheumatism as a cause of chorea has probably been overestimated. In the report of the collective investigation committee of the British Medical Association of 439 cases, only 26 per cent., or about one-fourth, had had rheumatism with distinct joint affection and fever. When we consider how common rheumatism is, especially in England, the question may well arise whether in these cases this disease was a necessary antecedent to the chorea. Many of these rheumatic cases occupied debatable ground. It is also of especial interest to know that a certain small number of cases were reported in which rheumatism appeared *first* during the choreic attack in patients who had never before had rheumatic symptoms. Considerable interest attaches, according to this report, to the influence of the exanthemata in the causation of endocarditis, which in turn might cause a murmur before and independent of the chorea, or predispose the heart to the production of a murmur under the choreic influence: 7 cases of these 439 were instances of the chorea of pregnancy, and are related in detail; 5 recovered, 1 died, and 1 was lost sight of. Several aborted or went into premature labor. The movements in some were very violent.

The blood of the choreic patient is often reduced in its normal constituents, but this anæmia does not differ from that found under other circumstances. In a case reported by Dr. Hirst, to be again referred to, the number of red blood-corpuscles was very much decreased.

PROGNOSIS.—The number of fatal cases of the chorea of pregnancy relative to the total number of cases of the disease occurring in this state is certainly very much greater than the relative number of fatal cases in simple uncomplicated chorea. Barnes[1] collected in 1889 all the cases of pregnancy complicated with chorea which he had been able to find. The total number was 56, of which 17 were fatal—about 30 per cent. These are certainly very alarming statistics. They, however, represent probably only the worst cases, or at least a large percentage of them are the worst cases, because the probability is great that fatal cases of the chorea of pregnancy are much more apt to be put on record than the cases which recover. I have known of at least 4 cases of pregnancy complicated with chorea which have never been recorded; 3 of these I have seen, and they are referred to now in this paper for illustration. The patients all recovered. If any one of these cases had proved fatal, it would probably have been published. Again, the fatal cases are not always reported as fully as could be desired, as given in Barnes' paper, and the question arises whether they were all cases of pure chorea, and whether any complications existed, as sepsis, hemorrhage, etc., which may have influenced a fatal result. Still, discounting all such possibilities, it seems positive that chorea in the pregnant woman is a grave disease and that it threatens possibly three serious results. In the first place, it may jeopardize the life of the mother, as has been seen. This appears to be especially so under some circumstances. Thus, the primiparous woman and the woman illegitimately pregnant appear to have contributed a large share of fatal cases. Levick[1] reported the case of a girl aged seventeen who had been seduced. She was bitterly reproached by her mother when her pregnancy was discovered, and immediately became violently agitated and convulsed in chorea. The case terminated rapidly in death. The possible influence of abortion and premature labor in contributing to a fatal result is an important question; certainly very many of the fatal cases have aborted. On the other hand, the question of producing abortion or premature labor as a curative measure will inevitably arise in grave cases, but the experience of others teaches that these procedures do not always bring relief. In this connection is indicated the second serious result which is always threatened by an attack of chorea during pregnancy; *i. e.*—the death of the child. Of Barnes' 17 fatal cases, the following figures are very significant: the number of cases is really 20, 3 of them non-fatal, because one patient had chorea in four succeeding pregnancies, and died in the last one; abortion, 4; undelivered, 4; stillborn, 4; born-alive, 3; not stated, 5. The non-fatal cases give the following results: abortion, 5; born-alive, 24; premature labor, 5; stillborn, 1; not stated, 5. Some of these cases had chorea in successive pregnancies, making a total of 40; 1 case developed chorea after labor. Of the cases non-stated and in the premature labors the results to the child cannot be given. It thus appears that of a total of 61 cases the result was disastrous to the child in 18 cases at least, giving about 28 per cent.

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[1] *Trans. Obstet. Soc., Lond.*, vol. x.

Finally, the relation of chorea to long-continued mental disorder is an important question when the prognosis of the disease is considered. Very few writers seem to have taken this into account, except Marcé, who says[2] that in non-fatal cases the grave maniacal state may sometimes leave after it divers affections of the intellect of variable duration. These serious results, while not to be ignored, are probably of very rare occurrence, or we would hear more about them in the numerous cases of chorea in pregnancy which are now on record. In the only case of long-continued mental disease associated with or following the chorea of pregnancy, which I have seen and which I have already narrated, the symptoms of insanity were not manifested until after the patient had had chorea for nearly five years, during which time she had borne two children. The kind of mental disorder then shown was melancholia, with partially systematized delusions of persecution and with marked mental weakness.

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[1] *Am. Journ. Med Sci.*, 1862.

[2] *Op. cit.*

Dr. Hirst's case, to which I have already referred in the paper on "Puerperal Insanity," was a most instructive one. This patient was a young primipara, illegitimately pregnant, who developed hemichorea in the sixth month. She was apparently cured of that, but rapidly ran down into anæmia, in which the blood-corpuscles were reduced in number at least 25 per cent. She became very weak mentally, "her reason quite gone." The condition was so grave that premature labor was induced in the eighth month, with the result of saving the child; but the mother did not improve in her mental disorder, the blood-corpuscles were still further diminished, and at the last report it looked as though the insanity would be permanent. In this case it is probable that the chorea and mental deterioration were effects of a common cause, rather than the latter the effect of the former.

TREATMENT.—No specific exists for chorea, and especially for the chorea which complicates pregnancy. Several drugs can often be relied upon to give good results in the simple, so-called idiopathic, chorea of childhood and youth, but I would not have much confidence in them in a case of severe chorea happening in a pregnant woman, although they might be tried. The two drugs which do the most good are arsenic and iron. The anæmic state often present indicates their use, but even in cases where anæmia is not marked they appear to be required. In the nervous clinic of the University of Pennsylvania, where I formerly saw many cases, the best results were obtained by a gradually increasing dose of Fowler's solution; thus, treatment was commenced with three drops t. i. d., and increased one drop daily until a physiological effect was produced or until twelve drops t. d. were given; then decreased, or even suspended for a few days. According to the collective investigation of the British Medical Association it seems that arsenic and iron were both used, partly because they are the fashion: both of them failed in some cases. The treatment without drugs and with full diet alone, according to that report, gave an average duration of ten weeks, which was about the average of treatment with drugs. Arsenic is reported to have done good in only about 3 per cent. of the cases.

But pregnancy seems to offer an obstacle to the treatment of chorea which is wellnigh insurmountable, although occasional cases are reported which have recovered and gone on to full term. In the very severe case which I once treated, referred to above, no sedative medicines did any perceptible good. Hyoscyamus, conium, and the bromides were used in vain. The girl was blanched, and was suspected for some reasons to have had syphilis. She was put on the "four chlorides," and improved both in her blood-state and in her chorea. This prescription calls for the corrosive chloride of mercury, the solution of the chloride of arsenic, the tincture of the chloride of iron, and hydrochloric acid in doses to meet the requirements of the individual case. The patient was lost sight of before her confinement.

Dr. Frühwald[1] recently reported rapid improvement from arsenic by hypodermatic injection, cure resulting in from three to four weeks. Fowler's solution, perfectly fresh, is mixed with an equal part of distilled water, filtered, and injected deep into the tissues, the skin being first washed with thymol. Increasing doses are used. I resorted to this treatment in the following case in the Philadelphia Hospital: E. H——, aged 19, married, had had an attack of chorea, confined to the right side, when fourteen years old. When seven months advanced in her first pregnancy she quarrelled with her husband, and was bitten by him on the breast. One or two days after this she began to have choreic movements. These increased in severity as pregnancy advanced. She was delivered at term. The child was alive, but died of convulsions when a few months old. The chorea did not stop at the confinement, but continued until the patient's admission to the hospital several months later. She was very anæmic, and at times lachrymose, with constant choreic movements of the face, neck, arm and leg muscles, more marked on the right side, and intensified by an abrupt question or by excitement of any kind. The twitching of the corners of the mouth and of the palpebral muscles was especially noticeable. Her treatment consisted of rest in bed at first, the administration of Blaud's pills, and arsenic, given hypodermatically, as recommended by Frühwald. Fowler's solution was used, with initial doses of three minims night and morning, increasing by two minims every second day, until sixteen minims night and morning had been reached. This dose was continued, the injections being made into the calves of the legs, until two large abscesses formed. This result was evidently due to some relaxation in our antiseptic precautions, although great care in this respect had been enjoined and practised. After these accidents the arsenic was given by the mouth until thirty-two minims t. i. d. were given, the effect being carefully watched. Under the hypodermatic treatment the patient's anæmia improved and the choreic movements decreased. The improvement continued during the administration by the mouth. Unfortunately, the case went from observation before restoration to health was complete. I am unable to say that this one case proved the superior efficacy of arsenic given in this way, but the impression made at the time was that improvment was more rapid than we had a right to expect.

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[1] *Deut. Med. Zeit.*, Jan. 3, 1887.

Cimicifuga has been much praised in chorea, especially by Dr. Hiram Corson. I have been disappointed by it. In the case seen in the Pennsylvania Hospital for the Insane narrated on a preceding page it had been given *ad nauseam* without perceptible benefit.

The salicylates may be tried if the case is attended or immediately preceded by marked rheumatic symptoms. Among the numerous remedies commended are sulphate and oxide of zinc, belladonna, gymnastics, galvanism, and change of air. None of them will be apt to prove beneficial, and some of them are impracticable in the chorea of pregnancy.

The following remedies may possibly be beneficial sometimes: Morphia may promote sleep when that is much interfered with, and then chloral may be a useful adjunct to it. But morphia is an evil thing to be relied on in long-continued and obstinate diseases. Inhalations of chloroform have been used with some success in some of these grave cases complicated with pregnancy. Chloroform acted better than ether in Dr. Goodell's case. Morphia under the skin and chloroform inhalations given by a careful and responsible hand appear to me to be probably the most reliable agents to control these wellnigh uncontrollable paroxysms. The spinal ice-bag is sedative, but difficult to keep applied.

The last consideration is artificial abortion and premature labor. It is incontestable that many cases of chorea in pregnancy recover at or soon after the confinement, but it is also a fact that some cases do not. The cases, however, which do not immediately recover are not made worse, but are no doubt put in a better position to make a recovery than they were in while big with child. It is of course a very grave matter to take the life of the unborn child, or even to endanger it as in a premature labor. The only rule that can apply is the very ancient one, that only the certain death of the mother justifies such a step. The statistics of Dr. Barnes show without doubt that women not unfrequently perish in this disease, and that the child almost always perishes with them. The obstetrician in some cases has to consider the question only of premature labor when the child is viable and the risk, therefore, is more justifiable. In Dr. Hirst's case the mother did not improve after premature labor, but the child's life was saved. This suggests the important question whether in severe cases happening in the eighth and ninth months the chances of saving the child are not *promoted* by a premature labor—whether it is not better so to remove it rather than allow it to continue exposed, as it must be, to grave risks in its mother's abdomen. It does not seem possible to formulate a positive rule to cover all cases: statistics must yet accumulate, and much, after all, must be left to the judgment and sense of the individual observer as applied to the requirements of the individual case. In cases of a mild type these serious questions will of course not arise at all, while in severe cases the indications of threatened danger to the mother or child, or both, will probably not be difficult to recognize.

TETANUS FOLLOWING ABORTION AND LABOR.

HISTORY.—The rarity of tetanus as a complication of abortion or the puerperium is evidenced by the general impression that it is even unheard of, and by the fact that very many of the standard works on obstetrics do not so much as mention the disease. One of the latest writers on tetanus, Nicaise,[1] says the puerperal state appears to be without influence in causing this affection. The leading authors, such as Dewees, Cazeaux, Ramsbotham, Leishman, Lusk, Playfair, and Fordyce Barker, ignore the subject—the later writers in spite of the fact that James Y. Simpson[2] published a paper on it as far back as 1854, and tabulated 27 cases which he had culled from various sources. Parvin is a notable exception, and devotes some space to tetanus in his recent valuable work. Curling[3] in his monograph on tetanus does not mention the puerperium among the causes, nor give an instance in his table of 128 cases. Laurie[4] in his statistics of tetanus gives 2 obstetrical cases in 221 cases due to all causes. It thus appears that very many have not even heard of tetanus in the puerperal state, and that very few indeed have had the opportunity or misfortune to witness it. It cannot, therefore, be the privilege of any one person to write upon the subject from wide personal observation. In the whole of medical literature probably not one hundred cases are reported with sufficient detail to be of use. Thus, any paper devoted to the consideration of tetanus in obstetrical practice must be something of a cento of the observations and records of a very few and widely scattered writers. The subject has two aspects of interest: one is strictly literary and historic, as has been indicated above: such a study will briefly occupy our attention first in this paper. The second matter of especial interest concerns tetanus in all conditions, and is not peculiar to it in the puerperal state: this is its probably infectious nature and bacteriological origin; and this, as will readily be seen, is a subject of great practical importance to the obstetrician as well as to the surgeon.

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[1] *Int. Encycl. Surg.*, art. "Inj. and Dis. of Nerves."

[2] "Cases of Tetanus," etc. etc., *Monthly J. of Med. Sci.*, Feb., 1854.

[3] *Treatise on Tetanus*, London, 1836.

[4] *Glasg. Med. J.*, vol. i.

Statistics will not be presented in this paper, because, in the first place, very little value is to be attached to them when founded upon such a limited number of cases as are attainable, which cases, moreover, are reported with various degrees of accuracy; and because, in the second place, many of the reported cases have already been subjected to the statistical method by Dr. Garrigues, who has extracted a relative value from them.

Tetanus in the childbearing woman was not unknown to the ancients. A few authors refer to it, and these have been quoted by every modern writer who wishes to give an appearance of erudition to his work. Thus, Aretæus[1] alludes to abortion as a cause. Archegines is quoted by Hervieux[2] as ascribing tetanus to abortion. These are about the only references to the subject in the ancients, except a sentence alluding briefly to tetanic symptoms to be found in the collection of Spachius under the head of *Martinus Akakia,* and which some have ascribed to an ancient author. Ætius, who wrote more fully on obstetrics than any other ancient, is said to allude to the so-called puerperal tetanus, but I have not been able to verify the quotation. These brief excerpts simply gratify literary curiosity, and are too meagre to convey much real information. Among the moderns Currie appears to have been the earliest to allude to this subject. In a paper[3] extolling the cold bath as a cure for tetanus he mentions a case in a woman as a result of a difficult labor in whom the "spasmus cynicus" and other symptoms of tetanus were present. Copland in his *Dictionary* merely says that parturition and abortion favor the occurrence of tetanus. Fournier-Pescay[4] in 1820 says he had seen the disease show itself in a puerperal woman who went to a "latrine" exposed to the winds, and suffered a suppression of the lochia. Velpeau in 1832[5] related the case of a young woman who developed trismus, and then tetanus, after abortion, and died in complete opisthotonus. Finucane de Nenagh[6] in 1838 reported a case following version, and remarkable for the fact that death came in fifteen hours. Symonds[7] refers to a case of his own. Storer[8] in 1842 related an extraordinary case in which an adherent placenta was allowed to remain and putrefy in the womb, and in which the patient developed tetanus and died. Berg[9] in 1847 printed an account of fatal tetanus in a lying-in woman, but the paper is not accessible to me. But the first paper of note upon the subject was Simpson's, which appeared in 1854, and which, because both of the importance of the subject and the eminence of the author, ought to have secured for the disease a place in every classical work on obstetrics. He collected 27 cases, several of them doubtful, and expressed some novel and advanced ideas for his day.

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[1] *Caus. et Sig. Acut. Morborum,* lib. prim. cap. vi. p. 5.

[2] *Maladies puerpérales, etc.,* Paris, 1870.

[3] *Mems. Med. Soc. Lond.,* vol. iii. p. 147 (about 1790).

[4] *Dict. des Sci. méd.,* art. "Tetanos."

[5] *Des Convulsions chez les Femmes, etc.,* Paris.

[6] *Lancet,* June 2, 1838.

[7] *Cyc. Pract. Med.,* art. "Tetanus."

[8] *Am. J. Med. Sci.,* Jan., 1842.

[9] *Med. Corspdz. Bl. d. Wurtemberg, Ærztl. Vereins,* Stuttgart, 1847, xvii. 344.

After Simpson's paper more reports of cases began to appear in the journals, but nothing like a careful treatment of the subject was again attempted until Hervieux in 1870 wrote a valuable chapter on puerperal tetanus in his work already quoted. Then Lardier wrote in 1874 his thesis[1] on the same subject—a work highly praised, but which I have not obtained. Collongues in 1878 and Benington in 1885 have contributed to the subject. In 1882, Henry J. Garrigues published the most elaborate statistical paper[2] on obstetrical tetanus which has yet appeared: in this paper he tabulated 25 cases after abortion and 32 cases after parturition, 57 cases in all. These were all the authentic cases he could find after much time and labor. They included all Simpson's genuine cases, as well as cases collected by Hervieux, Lardier, and Churchill, and additional cases collected by Dr. Garrigues himself.

The *Index Catalogue*, that "refuge of the uninformed," is not yet completed as far as the subject of "Tetanus," but I have obtained, by request, from Dr. Billings all his references to "Puerperal tetanus." These permit me to add some interesting cases which have apparently escaped the keen search of others. In 1848, Lebby[3] of South Carolina reported a fatal case in a young multipara after a perfectly normal labor, coming on after a slight exposure to a fog on the tenth day. This patient was bled heroically and otherwise reduced, and drenched with buckets of cold water, so that she lived only about one day after the initial symptoms. Blackshaw[4] relates a fatal case, after abortion and plugging the vagina, in a woman aged forty-eight years. Day,[5] Gibbon,[6] and Gibbons,[7] each reports a fatal case. All these patients had suffered from hemorrhage, hour-glass contractions, or adherent placenta and introduction of the hand, the tetanic symptoms appearing at the sixth to the tenth day. Blachez[8] relates a fatal case on about the fourteenth day. Atlee[9] reported a fatal case following abortion, which was especially interesting from the fact that the patient had received a bite or "scratch" from a dog some weeks before, and expressed great dread of hydrophobia. Smith[1] gives details of a fatal case of tetanoid convulsions coming on *before* labor was ended. It was probably not true tetanus, but, as consciousness was preserved, it does not look like eclampsia: the urine was not tested. Other cases are reported by individual observers.

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[1] *Du Tetanos puerpéral, etc.*, Paris, 1874.

[2] "Obstetrical Tetanus and Tetanoid Contractions," *Am. J. Obst.*, Oct., 1882.

[3] *Charleston Med. Journ.*, vol. iii., 1848, p. 283.

[4] *Brit. Med. Journ.*, vol. ii., 1865, p. 252.

[5] *Southern Pract.*, 1880, vol. ii. p. 307.

[6] *Trs. N. J. Med. Soc.*, 1878–79, p. 355.

[7] *San Francisco Med. Press*, April, 1864.

[8] *Gaz. héb. de Méd. et de Chir.*, 19 Juin, 1874.

[9] Quoted by McGugin, *Trans. Am. Med. Assn.*, 1864, vol. xv. p. 291.

Some physicians have had the unusual experience of seeing more than one case of tetanus in obstetrical practice. Aubinais of Nantes reported three cases many years ago. Wm. A. Gordon[2] had three cases in his own practice in five years.

Puerperal tetanus is evidently a much more common disorder in hot countries than in the United States and Europe; and the reason we have not heard more of it is that scientific observation does not prevail extensively in many of those lands. In tropical countries, such as India, however, where skilled physicians and medical journals abound, the records of this malady are not so meagre. More than thirty years ago Waring[3] in his *Notes* on some of the diseases of India spoke of the extraordinary frequency of puerperal tetanus at Bombay. In three years not less than 232 women were recorded as having perished from this disease. Native physicians have since reported cases. Bindabun Chattergee[4] had a case of tetanus after delivery in a Mohammedan woman. Doss[5] reported a case of trismus with septic infection following a neglected abortion, the patient recovering. Mootoosamy[6] had a fatal case in a Hindoo after craniotomy. Mullick[7] had a case with recovery under chloral and the bromides. He says the disease in India is usually fatal, but that the later the attack the more favorable the prognosis: thus, patients seized within a week after labor nearly always die, but not so in later cases. Roy[8] reported two fatal cases, one of them after miscarriage in a girl twelve years old—the youngest case probably on record; the other after labor in a patient aged sixteen.

Some of the major obstetrical operations have been followed by lockjaw. Paul Dubois in 1839 performed the Cæsarean section, and the woman died of tetanus on the seventeenth day after the operation. Dr. Robert P. Harris of Philadelphia informs me that of 121 deaths after the Cæsarian section in the United States no case was due to tetanus. It is a curious fact, however, that one child died of it thirty-six hours after its mother was operated on by Prof. Lusk, Nov. 21, 1887, at Bellevue Hospital, N. Y. Dr. Harris says that three deaths by tetanus have occurred after the Porro operation down to 1885, as follows:

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[1] *Med. and Surg. Reporter*, Sept. 20, 1873.

[2] *Am. Journ. M. S.*, 1866, p. 102.

[3] See notice in *B. and F. Med.-Chir. Rev.*, Oct., 1856, p. 558.

[4] *Ind. An. Med. Sci.*, 1854, ii. 471.

[5] *Ind. Med. Gaz.*, Dec. 1, 1873, p. 321.

[6] *Ibid.*, Nov. 1, 1877.

[7] *Ibid.*, Mar. 1, 1877.

[8] *Ibid.*, July 1, 1874.

Peyretti of Turin, death of mother on the tenth day, child living; Ficki of Warsaw, death on eighth day, child living; Parona of Novara, death on the eighth day, child living.

Tetanus after parturition has been observed in the lower animals. Denham[1] says that he once saw a fatal case in a cow after adherent placenta. Sir Thomas Watson[2] tells us that he saw a mare die of tetanus a few days after foaling. Mr. Jonathan Hutchinson[3] read a paper a few years ago to the London Obstetrical Society on certain causes of death in ewes during and after parturition, in which he gave details of an epidemic of tetanus among his own flock. About 30 suffered, and 8 or 9 died. No sheep were attacked except the ewes which had lambed. The literature of veterinary medicine would probably give other instances if searched.

It is not necessary to multiply examples which repeat simply the facts already referred to. I have not been able to verify and utilize, for want of time and space, all of the sixty-seven references which Dr. Billings has sent to me. These references are most of them additional to those contained in the now historic papers of Simpson, Lardier, and Garrigues; and may be appropriated, if desired, by some future statistician.

Puerperal tetanus has on one occasion, at least, been a subject of great medico-legal interest. Dr. J. Morris[4] tells us that a "Voodou" woman was recently tried in Baltimore for murder committed by criminal abortion. The patient had died of tetanus following this manipulation. A physician testified that the abortion could not have caused the patient's death, even indirectly, because tetanus never followed abortion. On this evidence the trial was discontinued, and a new trial commenced—not for murder, but for the criminal abortion. Other physicians testified that the woman died of eclampsia. This case illustrates very plainly that lockjaw following miscarriage and labor is unheard of by many physicians, although at the time of this trial nearly everything was on record which is now collected in this paper. It also appears in this case how the question of a diagnosis of tetanus from eclampsia may be raised. The woman's symptoms are not given in the paper.

The occurrence of traumatic tetanus in pregnant women has been mentioned by some writers. Wiltshire quotes a case from Dupuytren of a pregnant woman who had traumatic tetanus and did not abort. Allis[5] mentions a case of a woman dying of lockjaw at full term : the fœtal heart continued to beat for five minutes, but abdominal section

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[1] *Dublin Quarterly*, 1865.

[2] *Practice of Physic*, Philada., 1872, 522.

[3] *Obstet. Trans. London*, vol. xviii.

[4] *Maryland Med. Journ.*, Baltimore, 1885-86, xiv 137-139.

[5] *Phila. Med. Times*, 1875, 508.

post-mortem was not made. Some of the fatal cases of so-called "intermittent tetanus" in pregnant women may have been true tetanus of an unusually intermitting type. Such cases are reported by Mikschick[1] and T. C. Smith. Collins had a fatal case of tetanus complicating labor.[2]

CAUSES.—Exposure to cold and damp and sudden changes of temperature have been regarded for many years as especial exciting causes of lockjaw. In the tropics, where the contrast between the heat of the day and the coolness of the nights appears to be greater than in the more temperate countries, these causes have been especially regarded. Larrey[3] speaks of the nights being uncomfortably cool in Egypt, although the days were hot, and attributes tetanus to the coolness and humidity of the nights. This cause has been assigned for a number of the puerperal cases. One of these was said to be due to the patient lying all night in the draught from an open window: her disease was at first supposed to be a sore throat and stiff neck due to this cause. It is noticeable that a great many of the reported attacks of tetanus following abortion and labor have occurred in cases in which some difficulty, accident, or operation had preceded. Abortion, adherent placenta, flooding, dystocia of one kind or another, have been the precursors of many of these cases. Several authors have regarded the tampon as the immediate cause. Eclampsia is reported in one, but this fact suggests the possibility of the case being "tetanoid" due to uræmic poisoning, as in some other cases reported. The fact, on the other hand, that many cases are reported after normal labors does not disprove the traumatic nature of the disease, as even the simplest and easiest labors are not exempt from tears and wounds of the soft parts. The statement of Verneuil, that all tetanus is traumatic, that spontaneous or idiopathic tetanus does not exist, appears to me to be the most consistent with our knowledge of the subject. If it can be proved that the essential cause of the disease is always a microbe, then the importance of numerous and unrecognizable—so-called exciting—causes diminishes very much.

Moral causes have been claimed for tetanus by some writers. Wiltshire[4] reports two cases in which a decided mental excitement appears to have been a forerunner of the disease: in one of these a lady became pregnant illegitimately during the absence of her husband abroad, but a more rational explanation of her case is found in the probable fact that a criminal abortion had been performed.

SYMPTOMS.—The initial symptoms of tetanus are almost always in the muscles of the jaws and neck. This is shown in nearly all the cases reported after abortion and labor, and is the same in surgical and so-called idiopathic lockjaw. In fact, the onset of the symptoms and

[1] See Garrigues' paper.

[2] *Med. and Surg. Rep.*, 1877, vol. xxxvi. 129.

[3] *Op. cit.*

[4] *Obstet. Trans. London*, xiii. 133.

the character of them are the same from whatever cause this terrible disease may arise; hence, any person who has seen a case after a surgical lesion ought to be able to recognize one when it occurs during the puerperium. This onset of tetanus was well marked in a fatal case following Allingham's operation for hemorrhoids, performed by Dr. John B. Deaver, which unfortunately occurred in the writer's practice a few months since. This patient, a man who had been doing perfectly well, was seized suddenly in the afternoon of the sixth day with a temporary stiffness of the jaws and a "queer feeling" in the back of his neck—exactly as is described by some authors who report cases of the puerperal class. When first seen within an hour no stiffness was observable, but the patient was sitting up in bed very pale and agitated. I think he suspected lockjaw, but he said nothing about it. Within a few hours trismus and retraction of the head were well marked, and the terrible suspicion was confirmed which the first ominous symptom had excited. I was convinced from close observation of this case that these initial symptoms are partly *subjective,* and hence liable to grave mistake. When I first saw the patient he opened and shut his mouth and moved his head backward and forward with perfect freedom, but he held his hand on the nuchal region and insisted that something was wrong *there.* Although suspicious and fearful of the true nature of the malady, I was also inclined to dismiss the idea and regard the case as one of "nervousness." A number of the puerperal cases, as will be seen, have thus been dismissed at first as "hysterical."

As the case advances the muscular stiffness becomes more general. The muscles of the back become involved, and, along with those of the jaws and neck, are usually the most affected. The spasms are tonic in character, but are liable to spells of increased severity, during which the cramp-like spasm becomes intensely painful to the patient and terrible in the extreme to witness. In these exacerbations the head is violently drawn backward, the jaws fixed, the back arched, the lower limbs usually are rigid and extended, and the patient assumes the position of opisthotonus. The face is flushed and somewhat dusky at these times, the eyes rather protruding, and the facial expression distorted in the horrible sardonic grin. Sweat streams off of the body from every pore. The unhappy patient in my case, as in some others reported, constantly kept the handle of a spoon or some other hard substance inserted between his teeth. The consciousness is unaffected: this adds much to the horrors of the case.

These exacerbations are easily excited by peripheral irritation. The slightest shock, or even noise, is sufficient, as the shutting of a door or a draught of air. Attempts to feed the patient are especially provocative of these spells. In many cases swallowing is quite impossible.

Nutritious or medicinal enemata excite these attacks, and are sometimes immediately expelled with violence.

The muscles of the abdomen are usually tense and board-like, and occasionally, it is said, the muscles of the anterior parts of the trunk are most convulsed and draw the body into a position of anterior curve or emprosthotonus.

The pulse soon becomes weak, and in bad cases exhaustion from starvation and the violence of the disorder soon appears. Some cases have proved fatal in a very few hours; most fatal cases linger from one to three days; occasionally a fatal case is prolonged more than this.

The temperature in tetanus is usually increased, and some cases are reported in which it ranged very high. Some observers report a continued rise for a period after death.

The respiration, especially during the excerbations, is embarrassed; mucus collects in the bronchial tubes and cannot be expectorated; the face becomes congested and cyanosed.

Death usually occurs from exhaustion and the interference with respiration.

PATHOLOGY.—The chief interest which attaches to the subject of tetanus at present concerns its etiology and pathology. In a brief review[1] of the subject which I made about one year since some of the following facts were stated: The infectious nature of the disease had attracted attention long before the present epoch of microbian pathology had subjected it to the test of experiment and scientific induction. According to Audry,[2] Ambrose Paré believed that foul dressings were one of the causes of it. Bajou observed that trismus nascentium diminished when the umbilical wound was kept clean. During the Seven Years' War there were, it is said, terrible epidemics of tetanus. Larrey observed something on a smaller scale in Egypt. He tells us[3] that he had quite a breaking out of it after the battle of the Pyramids and the battle of Aboukir. In Denmark antisepsis has freed one maternity from trismus which had ravaged it. Colles stated long ago[4] that attention to the umbilicus secures almost certain immunity from tetanus neonatorum. Cagnat, having castrated six horses with the same écraseur, saw them all die of tetanus; the écraseur being then disinfected the mortality ceased. Huvelier lost by tetanus fifteen horses in as many operations performed at one time. Anger has seen a dog develop tetanus from a horse. Verneuil advocates the theory of the equine origin of human tetanus. Experiment seems to confirm these clinical observations. Carl and Rattone have inoculated tetanus from a patient with a pustulous sore on his neck. With injections of their dilution they had trismus and opisthotonos in eleven rabbits out of twelve. Rosenbach claims to have discovered the specific microbe of tetanus, but his claim has not been generally allowed. Bonome has also claimed to have discovered a bacillus "very minute and transparent." Verneuil[1] has declared that he is convinced of the non-existence of spontaneous tetanus. A microscopic trauma is easily followed by a true traumatic tetanus. He believes that tetanus is related to virulent or infectious microbian diseases, and always has a specific cause, a virus coming from without.

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[1] *Annual of the Universal Med. Sciences*, art. "Tetanus."

[2] *Lyon. Méd.*, Aug. 14, 1887.

[3] *Mém. de Chir. militaire, etc.*

[4] *Dub. Hosp. Rep.*, vol. i.

Shakespeare has inoculated rabbits with material from the medulla and cord of a horse which had died of tetanus. His researches tend to show, with those of other experiments, that traumatic tetanus in the horse and mule is sometimes at least an infectious disease, transmissible to other animals. Peiper[2] reports the following interesting facts. An infant developed tetanic symptoms five days after birth and one and a half days after the falling of the cord. The navel wound was suppurating. Five mice were inoculated from this matter. Tetanus appeared in three mice and death quickly followed. Guinea-pigs were inoculated from the dead mice, and died in five days.

The epidemic of tetanus among his parturient ewes, which has been reported by Mr. Hutchinson,[3] has been already noticed. Puerperal tetanus in sheep is said to be rare, yet in this instance it invaded a flock, attacking thirty and killing eight or nine. This certainly looks like infection. No sheep in the flock were attacked except the ewes after parturition. Mr. Hutchinson attributed the malady to a certain kind of food, but this does not appear plausible.

It is a curious fact that Simpson in his paper[4] on puerperal tetanus in 1854 distinctly stated the possibility of a "special blood-poison" at the site of the wound or elsewhere, and suggested the propriety of trying to inoculate one animal from the blood of another dying of tetanus. This was certainly an anticipation of the now prevalent opinion and work on the subject. In one of the cases in his list the mother was attacked three days after labor and died; the child also soon died with trismus. Mootoosamy[5] says that puerperal tetanus in India is due to the uncommonly bad hygiene of the huts. It is not so common in the lying-in hospitals as among the natives in their own homes.

As an illustration of the possible infectiousness of tetanus I may refer to a case of my own which occurred recently, and which is given in more detail elsewhere. The case was not puerperal, but followed upon an operation for hemorrhoids. The patient died at the end of the second day of his tetanus and one week after the operation. There was no known source of infection from any preceding case. A segment of the upper cervical cord was taken out and given to Dr. E. O. Shakespeare of the Philadelphia Hospital. From this section of the cord Dr. Shakespeare made inoculations beneath the dura mater of the brain in several rabbits. One of these rabbits died tetanic, but after several weeks. Another littered, and the young of this litter exhibited unusual motor excitability, and several of them died in tetanoid spasms.

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[1] *Le Progrès med.*, 1887.
[2] *Cent. f. klin Med.*, 1887.
[3] *Op. cit.*
[4] *Op. cit.*
[5] *Op. cit.*

The production of a ptomaïne due to bacteria has been regarded by some as the exciting cause of tetanus in these cases of probable infection. The telluric origin of the microbe is possible.

The intention in this brief reference has not been to advocate any special pathological theory, but merely to state the case. The subject must evidently be made the field of wider and more critical research. It appears conclusive, however, that tetanus does sometimes present an infectious and epidemic character, and must in this aspect be of special interest and importance to the obstetrician. The so-called puerperal tetanus has thus prevailed in India and in the lower animals in our own climate; while trismus in newborn infants, which has been sometimes such a scourge, appears to be quite amenable to antiseptic treatment.

No other attempted explanation of tetanus need be stated here. It has thus far been a disease without a satisfactory pathology, and uniform anatomical lesions after death have not been reported. Lockhart Clark has made some careful microscopic studies of the histological changes in cases of tetanus, but they appear to be as much the effects as the causes of the disease. In septic cases the possibility of the symptoms being due to meningitis ought not to be forgotten.

DIAGNOSIS.—Tetanus may be confounded with strychnia-poisoning, inflammation of the cerebro-spinal meninges, and hysteria. This latter disease is especially apt to be erroneously ascribed to the puerperal woman who becomes the victim of lockjaw. The early symptoms, which are always referred to the throat and neck, have been mistaken a number of times for inflammation of the throat and stiffness of the neck-muscles due to exposure to cold. It must be borne in mind also that some cases have been reported as "tetanoid" which are probably due to uræmic poisoning and have no relation whatever to true tetanus. Simpson[1] says: "Tetanus, when it has taken place in obstetric practice, has apparently been repeatedly mistaken, in its earliest stages, for an attack of cynanche, or even oftener, perhaps, for some irregular form of hysteria." The first symptoms may thus be overlooked as unimportant, as in Velpeau's case. In this instance a young woman was admitted to the hospital after a miscarriage, and was thought to be shamming nervous symptoms: a change of service occurring, she was somehow ignored or overlooked until found dying in opisthotonos. Day's fatal case of tetanus came on ten days after labor and after great emotional disturbance, which seemed to be the immediate exciting cause, and which might easily have been regarded as hysterical. On the other hand, hysteria may be mistaken for tetanus. Several such cases are reported. Morris[1] published details of a case of intermittent so-called "tetanus" during pregnancy, marked by rigidity, loss of consciousness, sobbing, etc., which was probably hysterical. F. H. Gordon[2] reported a case which he called "tetanus from sudden arrest of the catamenia." It was a typical case of hysteria in a girl sixteen years old, and was in no wise connected with either tetanus or pregnancy. Fournier-Pescay[3] says that he has observed a case of tetanus during a hard, ineffectual labor. The labor was terminated by art, and the tetanus immediately ceased. Such a case could have been one of some temporary emotional disturbance only.

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[1] *Op. cit.*

The history of the case, the emotional element, the loss or assumed loss of consciousness, the changeableness of symptoms, the absence of trismus between the exacerbations, are a few of the important features which distinguish hysteria from tetanus.

Tetanus is very similar to the effects of poisoning by strychnia. I have not seen a case of strychnia-poisoning in the human being, but I have observed it in the dog, in which animal the most characteristic symptoms are tonic shocks very rapidly repeated, almost as in clonic spasms, but with persistent stiffening, at the same time, of the body and limbs in opisthotonos. These attacks remit as in tetanus, perhaps more completely. The duration of the symptoms is a guide of some importance: fatal cases of strychnia-poisoning, as a general rule, do not last as long as tetanus, although in this connection it ought to be remembered that in a case of puerperal tetanus following version, reported by Finucane, death resulted in fifteen hours.

The possible relation of uræmia to some states of muscular rigidity, and hence the possibility of mistaking uræmic symptoms for tetanus, are interesting topics in this connection. It does not seem, at first sight, as though there could be much possibility of confusion here. Some of the reported cases, however, suggest this possibility. Tonic, persistent spasm is sometimes seen in uræmia. I have seen great rigidity of an arm and other muscles, and even spastic hemiplegia, persist in uræmic coma during the intervals between the fits, although I have never seen anything nearer than this to a suggestion of tetanus. Dr. Garrigues' valuable paper was suggested to him by a case which he describes as "tetanoid contraction symptomatic of uræmia, etc.," but which was certainly not related to tetanus in any sense. It occurred in a colored woman pregnant with her second child: she had subnormal temperature and was stuporous. She had rigidity of the masseters and muscles of the neck and limbs. The autopsy revealed chronic nephritis. Dr. F. Curtis Smith[1] also reports a fatal case of "tetanoid" convulsions coming on before labor was ended, but without loss of consciousness. The urine, unfortunately, was not tested.

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[1] *Lancet*, Sept. 27, 1862.

[2] *Western Med. and Surg. Journ.*, N. S. 5, 1846, 391.

[3] *Op. cit.*

In a case reported as puerperal tetanus by Dr. Angus Macdonald[2] the autopsy revealed blood-clots filling the lateral ventricles and small extravasations in the corpora striata. The patient had been unconscious, and had had stertorous breathing. It was evidently not tetanus. The custom, which appears to have prevailed more in the past than it does in the present, of calling spastic or tonic states of the muscles "*tetanoid*," is a bad one, as the term is a misnomer, and is responsible for the report of some cases which have been erroneously classed with the cases of true tetanus following abortion and labor.

The question may arise whether a septic meningitis of the spinal or cerebro-spinal type may occur after a miscarriage or the puerperium, and be mistaken for tetanus. Not a few of these reported cases have evidently had a septic element in them. Simpson speaks of a patient passing fetid clots from the vagina. One of the cases reported in India had a purulent discharge from the vagina, following a craniotomy. The conditions are very favorable to septic infection in many of the cases reported, as the tetanus in them followed dystocia, flooding, adherent placenta, introduction of the hand, etc.

The effect of severe hemorrhage in causing convulsive phenomena was pointed out by Marshall Hall and others. McGugin[3] gives a fatal case of tetanic rigidity after profuse hemorrhage. Such a case would probably be soon apparent and rapidly fatal, and not be likely to be confounded with true tetanus, which usually comes on several days after labor and its accidents.

PROGNOSIS.—Tetanus is an exceedingly fatal disease, and not less so after abortion and labor than in surgical practice. According to Dr. Garrigues' statistics, of 25 cases of tetanus due to abortion, 23 died; of 32 cases following parturition, 27 died. Of cases which I have collected, not included in these statistics, the almost uniform result has been rapid death. The duration of the disease varies. Of the above cases in which the duration is stated, the figures are as follows: Of 22 cases following abortion, 19 lasted from one to eight days; of 25 cases following parturition, 22 died within the same short space. The longest time observed definitely was twenty days. Dill[4] reports a case of recovery in a woman who was ill seventy-two days; her mind was affected. It is doubtful if the case was tetanus.

I do not know whether the relative mortality is higher in puerperal than in non-puerperal cases. It is possible that the special conditions of the puerperium may render a patient less able to withstand such a terrible malady. Conner[1] gives the following figures from traumatic cases in civil and military hospitals for thirty years: Of 1332 cases, 1060 were fatal (79.6 per cent.).

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[1] *Med. and Surg. Reporter*, Sept. 20, 1873.

[2] *Trs. Edinb. Obst. Soc.*, 1878, iv. 101–116.

[3] *Op. cit.*

[4] *Brit. M. J.*, 1882, ii. 685.

TREATMENT.—The treatment of tetanus is one of the opprobria of therapeutics. It is one of the most hopeless tasks, apparently, to combat it with the remedies used in the past, if we except two or three. Chloral, the bromides, cannabis Indica, and Calabar bean have been especially recommended, and have had, next to opium, the most extensive trial. From the standpoint of physiological therapeutics it would seem that most of these drugs are admirably adapted to control tetanus but in practice they have often failed.[2] This failure may have been due sometimes to the timid or inexpert way in which they have been used, or to the inertness of the drugs. It requires a finely-balanced mind, as Sir Thomas Watson observes, to conduct a duel between two opposing agents, either of which may kill the patient in the fray. Many practitioners will not have courage to push Calabar bean, as Ringer suggests, till "just short of arresting the breathing." This is a feat in which the physiological therapeutist only in his laboratory can hope to succeed, and then upon a dog or a rabbit only.

I believe that chloral and the bromides are probably the best remedies, just as they are the most familiar agents, in the hands of the general practitioner. The other substances may be inert as found usually in the shops, and their action is not as well known to many as that of the others. Opium and its preparations have been much relied upon, although recently I have heard theoretical objections urged against them. Hutchinson found opium the most useful remedy for lockjaw in sheep which had lambed.

Inhalations of chloroform or ether appear to promise much, but they have often been disappointing. The tetanic spasm may be overcome temporarily, but as soon as the anæsthetic effect passes away the tetanus is apt to recur.

The great difficulty often encountered in treating tetanus is the almost impossible administration of food and medicines by either the mouth or rectum. In a rapidly fatal case I have seen any attempt to give fluids by the mouth bring on violent spasm, opisthotonos, embarrassment of respiration, and choking which made further attempts simply out of the question. When the trial was made by the rectum a spasm would almost invariably occur and expel the fluid violently. The skin can of course be used for medication with some substances, but nourishment by it cannot support the system in the rapid exhaustion which sometimes comes on.

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[1] *Am. Syst. Med.*, art. "Tetanus."

[2] See Wood's *Therapeutics* for some statistics.

For more elaborate details of treatment reference must be made to the general works on therapeutics and special works on tetanus, the remedies for which are the same in puerperal as in other cases.

The facts that many reported cases have followed adherent placenta, and that some of them have had the symptoms of septic infection, suggest the necessity in these puerperal cases of careful examination of the womb and removal of any remaining débris. It is doubtful, however, if such care could modify the disease after it is once declared; for, even supposing a local septic infection, the mischief has been done; but the propriety of such care as an extra safeguard cannot be questioned.

TETANY.

Several forms of rigid or tetanic spasm have been described by various writers, some of which have been noted in pregnant women especially. They have been called "tetanoid spasms," "intermittent tetanus," and "tetany." I believe that the majority of the cases described under these names are hysterical, and in no sense related to true tetanus. They will not, therefore, be separately described in this paper. Hysterical cases are nearly always to be distinguished by altered states of consciousness and the emotions which are not observed in tetanus, as well as by an intermittency of the paroxysms and a general bizarre aspect of the case, which is not usually difficult to recognize. Tetany, however, appears to be a distinct, somatic affection, without special psychic or hysterical phenomena, which has been observed and described by the French especially. Very few instances apparently of this affection in childbearing women are seen in this country. Trousseau[1] has a long descriptive chapter on the disease, in which he reviews its history, symptoms, etc. He says that it is seen in nursing women especially, and speaks of having observed more cases of it in a ward devoted to wet-nurses than all other cases combined. Hervieux[2] also has an elaborate chapter on the subject, but it is founded on very few cases, and these not observed by himself. He confines his description to cases happening during pregnancy, some of which have been fatal, and are possibly distinct from the simple tetany of nursing women. In fact, the cases reported in detail are few, and the disease, with all its classic features, appears to be traditional with some writers as a distinct entity in pregnant and nursing women. Loss of blood, prolonged lactation, diarrhœa—in short, various exhausting accidents or processes—appear to be important factors in its causation, and suggest the likelihood of the disease being practically identical with the cramp-like seizures which occur in cholera and choleraic diarrhœa. The fact, again, that the tetanic symptoms can be brought on by pressure upon the blood-vessels and nerves of the limbs gives them a partial resemblance to the painful cramps which some women suffer during labor when the advancing head irritates the nerves and compresses the vessels.

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[1] *Clinical Lectures*, New Sydenham Soc., vol i. 370.

[2] *Op. cit.*

Tetany, as described, is characterized by painful, intermitting, cramp-like spasms, of the extremities especially, often exclusively. These spasms are apt to begin in the fingers or toes and to advance up the limbs. In severe cases the muscles of the trunk may be involved, causing rigidity of the neck and opisthotonos, although this latter appears to be rare. The fingers may be flexed into the palm : a more common form, however, is the so-called "obstetric hand," in which the fingers are held together at the ends as the obstetrician holds them for introduction into the vagina. The attack commences with a sensation of tingling in the fingers and toes, and is sometimes marked with anæsthesia.

The distinctions between tetany and true tetanus appear thus to be easily made. Tetanus begins in the jaws and neck, and is most marked in the trunk; tetany is especially seen in the extremities. The latter, again, is markedly intermittent, and, while painful, is benign; the former does not completely intermit, and is often rapidly fatal. Gauchet[1] has described the most characteristic case of these peripheral cramps spreading from the fingers and toes upward, accompanied with pain. The patient slowly recovered after labor.

It is not necessary to enumerate the various antispasmodics, most of which have not been very efficacious in these tetanoid seizures. Bromide of potash has relieved tetany in children. Trousseau advocated ice to the spine. The removal of the cause, as diarrhœa or prolonged exhausting nursing, is indispensable.[2]

EPILEPSY IN PREGNANCY.

This subject is of practical importance chiefly as it concerns the differential diagnosis of epilepsy from hysteria in pregnant women and from puerperal eclampsia. It has also occasionally been brought into prominence by the revival at stated intervals of an old belief that pregnancy has a beneficial influence upon epilepsy. Again, it has been asserted that pregnancy has been the starting-point or original exciting cause of epilepsy; and, finally, some observations are of record which tend to prove that pregnancy, instead of relieving, has tended to aggravate pre-existing petit or grand mal.

It appears very evident, from some reports of cases, that the older observers failed to distinguish true epilepsy occurring in pregnant women from attacks of hysteria. Women whose convulsive disorders are most apt to appear about the menstrual periods, and whose fits last for almost an hour, are probably hysterical. These manifestations may continue during pregnancy, and may thus confuse the diagnosis. The history of the cases, the psychic disorders, the prolonged duration of the attack, the fact that the hysteric spasms are rather rigid, opisthotonic, and indefinite, in marked contrast to the short, furious characteristic clonic spasms, with profound unconsciousness and biting of the tongue, which identify epilepsy, are some of the diagnostic data upon which a differentiation can be based with confidence.

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[1] *Union Med.*, 1860, vii. N. S. 309.

[2] For a description of tetany in all circumstances see Gowers' *Dis. Nerv. Syst.*

The diagnosis of puerperal eclampsia from epilepsy cannot ordinarily, at this date, present difficulty. The easily recognized uræmic origin of the former, its abrupt beginning, and the absence of a history of such seizures; the albuminous, even bloody, urine; the œdema, the precedent headaches and dimness of vision; its frequent returns at brief intervals and intermediate coma; its occasional epigastric pain or crisis; its rapid course and often fatal termination,—all characterize a disease which is essentially distinct in origin, pathology, and clinical history from epilepsy, to which it bears only a superficial resemblance in its convulsive phenomena. It had been confused with true epilepsy before its uræmic nature was recognized.[1] I have recently had in practice a case of puerperal eclampsia in which intense pain in the epigastric and umbilical region was a marked prodromal symptom, and preceded the first convulsion at least four hours. It was a third pregnancy. The patient recovered. I thought the abdominal pain might be due to a congestion of the kidneys.

Many writers apparently have believed that pregnancy can and does influence epilepsy for good. This belief appears to be traditional, and is probably one of the numerous popular notions which have sprung up about the mysterious *morbus sacer*. Physicians have been influenced by this tradition, and have simply given it expression without always subjecting it to necessary criticism or verifying it by observation. Velpeau[2] says it is proved by many facts that pregnancy is able to suspend ordinary epilepsy, and he himself knew of an example. Tyler Smith[3] collected 15 cases of epileptics who had been pregnant, the cases giving a total of 51 pregnancies. He says that "generally the epileptic attacks were fewer, and in some cases disappeared altogether, during gestation." This paper has a firmer foundation upon recorded cases than most papers on the subject: the one element of doubt is whether some of these cases were not hysterical women. Echeverria,[4] whose work appears, on this subject at least, to be rather a compilation than a critique or a record, gives the names of Van Swieten, Schenkius, Tissot, Maissonneuve, Herpin, Sieveking, and others who give examples of epilepsy being arrested by gestation. Gowers[1] says: "In most cases of epilepsy the attacks do not occur during the puerperal period;" but this period is very variable with both patients and their physicians. We have epileptics in the Philadelphia Hospital who have borne children, but I am not able to make a more accurate statement than one based upon the reports from memory of these women themselves. Any report to be accurate ought to be based upon a thorough knowledge of the relative frequency of the fits for a long time before as well as during pregnancy; and such records have not been kept. The following are brief notes of some of these cases:

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[1] See discussion in *Lancet*, 1849, xxiv. 644.

[2] *Des Convulsions chez les Femmes, etc.*, 1834.

[3] *Lancet*, 1849, *loc. cit.*

[4] *On Epilepsy*, 1870.

Mary L——, aged 44 years, had her first fit when nine years old. She says it was due to fright, as not a few epileptics claim. In her case it was caused by a fall into a river. She has had nine children, and says that she never had a fit during any one of her nine pregnancies. The seizures have always reappeared a few days after labor. This patient has very bad epileptic spasms, with loss of consciousness and frothing at the mouth. She invariably cries out "Fishes!" makes a motion as though to pick something off her dress, and falls convulsed. She has frequently injured herself in her seizures. The fits come about two months apart, and have never intermitted as long as nine months except during her pregnancies. She is a reliable woman of some intelligence. None of her children have been epileptic. I think her statement is authentic.

Matilda G—— is a confirmed epileptic. She has mental deterioration with loss of memory. She had one child about nine years ago. Her account is of no value.

Ellen L——, who is reported as an epileptic, had her first fit about the time of the birth of her first child, and another after the birth of the second. The urine was not albuminous. This patient also is very stupid, and her account cannot be accepted.

Two other patients give such indefinite histories that it is not worth while to print them. One is probably a case of hysteria. These five cases show how difficult it is to secure reliable data upon which to base an opinion. One of T. Smith's cases is reported to have passed through ten pregnancies without a convulsion.

When we reflect that epilepsy is rather a symptom than a distinct, always identical, disease, and that it may depend upon widely differing irritations and alterations in the cerebral cortex, it will be seen at once how unreliable any general statement must be that pregnancy always modifies it at all or in any particular way.

Before the uræmic origin of eclampsia was recognized another notion prevailed, that an epileptic who became pregnant was more liable than other women to have puerperal convulsions. This mistake is easy enough to understand. The fits of the epileptic happening toward the close of pregnancy or in the puerperium were probably called "puerperal convulsions." There is no especial reason why an epileptic should have the characteristic changes in the kidneys and urine upon which puerperal eclampsia depends; and the belief could only have arisen from the general tendency to confuse the two species of convulsions. In the discussion following Dr. Tyler Smith's paper this confusion was manifest in the remarks of some. In the 51 pregnancies in epileptic women reported in that paper only 2 cases of "puerperal convulsions" were observed, but the condition of the urine is not stated.

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[1] *Dis. Nerv. Sys.*

Finally, with reference to the statements that pregnancy has been the primary exciting cause of epilepsy, and that it has aggravated cases already established, the observation, I believe, will hold good that most of such statements are of a very general character, and that some of the cases are capable of a different interpretation. Reynolds[1] says that epilepsy may be induced in pregnancy "by some unknown circumstances determining a relative excess of change in the medulla" during the general change of that process; but nothing more definite and satisfactory. Terrillon[2] gives full details of a case of epilepsy in which the attacks were worse during pregnancy. Some reported cases were probably uræmic, as Durrant's,[3] whose patient, aged twenty years (probably a primipara), had her first fit in the eighth month of pregnancy, and continued to have fits for four months afterward.

Echeverria[4] has recorded an authentic case of epilepsy which first appeared in a first pregnancy. The attacks recurred in and after every subsequent pregnancy, and were accompanied after labor with mania. The patient had borne six children, all but the first epileptic. The seizures were nocturnal, the patient frothing at the mouth and biting the tongue during the paroxysm. She was positive that she never had attacks except during her pregnancies, but as the seizures were nocturnal, we cannot be sure of this asserted fact.

I think the general conclusions can be allowed that as the pathology of epilepsy is little understood, and probably varies in different cases, it is impossible to give an exact categorical statement of the effect, either good or bad, of such a process as pregnancy upon it; that clinical observations appear to prove that in occasional cases of epilepsy the attacks are less frequent during pregnancy, but that in very rare cases they are increased; and that, finally, the older observers have sometimes confused hysteria and uræmic convulsions with so-called essential epilepsy.

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[1] *Syst. of Med.*, art "Epilepsy."

[2] *Ann. de Gy.*, June, 1881, 401.

[3] *Prov. M. and S. Journ.*, 1845, vol. ix. 610.

[4] *Op. cit.*, p. 222.

CEREBRAL HEMORRHAGE AND EMBOLUS IN PREGNANCY AND THE PUERPERIUM, AND PRESSURE-PALSIES FOLLOWING LABOR.

It is intended to write a brief notice only of these subjects, and to emphasize in it the etiological relation only of pregnancy and the parturient processes to several forms of paralysis. There is no such thing as a "puerperal paralysis"—which is a term used by many authors—if anything special or distinct is meant by that expression. The progress of pregnancy or labor may be marked or followed by several forms of loss of power—hemiplegic or localized—some of which are directly traceable to those processes as exciting or essential causes, but which in themselves are in no way different from these palsies happening in other circumstances. Therefore, these affections are probably best and most appropriately described in general textbooks of medicine or in special treatises on neurology. For the present purpose I will note simply a few essential facts: first, about hemorrhage and embolus in the cerebrum; and, second, about that particular paralysis which is more distinctly "puerperal" than all others—*i. e.* the loss of power which characterizes a neuritis of one of the main trunks of the leg, caused by pressure of the child's head during labor. Other forms of paralyses occasionally happen, due to hysteria, or, worse yet, to septic infection.

Authors, both ancient and modern, have had a great deal to say about the so-called puerperal paralyses. Hervieux,[1] with his accustomed diligence, has made a long collection of these writers, and has presented their chief ideas. From these it is evident, as might be anticipated, that the diverse forms of paralysis had not always been differentiated, the various apoplectic, convulsive, and comatose states being more or less confused. The pathology is peculiarly archaic, and contemplates the milk and lochia as the chief causes of these disorders, especially when either of these fluids is suppressed. Churchill,[2] years ago, composed a lengthy article on paralysis occurring during gestation and in childbed. He collected in his paper 34 cases from various sources. A brief critical survey of these cases shows very clearly that they are a heterogeneous lot, many of them mere coincidents of gestation and labor, the whole number exhibiting a variety of pathological states. An accurate diagnosis is impossible in some cases because of the very meagre details with which they are reported, but the following is Churchill's own classification, slightly modified: Hemiplegia, 19; paraplegia, 4; facial paralysis, 6; amaurosis, 5; deafness, 3. Several patients are included twice in this list. Some of these cases of hemiplegia were evidently hysterical, as in one woman who had hemianæsthesia coming and going. These were the cases which recovered. But in the cases in which the hemiplegia was evidently due to cerebral hemorrhage or embolus the course was the same as in these cases under all circumstances: they did not completely recover, and some of them died. The paraplegias were either pressure cases of neuritis or due to spinal meningitis, possibly septic: one of these women stood in water up to her knees while at work on the eighth day after labor. The facial paralyses (Bell's palsy) were without exception simply cases of acute inflammation of the seventh nerve happening accidentally in pregnancy or the puerperium. The instances of amaurosis were in cases of puerperal uræmia, some of them with convulsions, in which the obscuration of vision was merely a symptom of this toxæmia, as is frequently observed. The same may be said of deafness. It thus appears that if we deduct the hysterical, uræmic, and merely coincident cases, we have remaining a very few cases of organic brain, cord, and nerve lesions which probably owed to pregnancy or parturition an exciting cause.

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[1] *Op. cit.*

[2] *Dublin Quart. Journ. Med. Sci.*, vol. xvii.

Imbert-Gourbeyre[1] has written an elaborate paper on these paralyses, in which he classifies in divisions and subdivisions almost all possible forms of paralysis which the childbearing woman may suffer. Such a paper to be complete ought to be little less than a treatise, clinical and pathological, on this department of neurology, because only in such a treatise could these diseases be studied with profit. Most of them, as already said, bear to pregnancy and parturition only an accidental relationship; and it is sufficient for the purpose of this paper simply to state and illustrate that fact.

We ought to distinguish at once those cases in which these accidents are simply coincidents, and not directly related to the physiological processes now considered. Apoplexy has been reported in pregnant women, but I do not know that pregnancy has any especial influence to produce it. The supposition does appear reasonable, however, that the plethora of pregnancy, hence the increased blood-pressure, may act directly here to precipitate the attack, when the blood-vessels have been previously weakened by atheromatous disease or the kidneys and heart have been conjointly involved in that general state of arterio-capillary fibrosis which favors this accident.

Embolus in a cerebral artery is most frequently the product of an endocarditis. The small fibrinous mass is swept off by the blood-current and lodged in one of the vessels of the brain. The relation of pregnancy and labor to this pathological process can, therefore, be only incidental. The nature and extent of the symptoms in these cases will depend entirely upon the size and distribution of the vessel occluded. As a matter of fact, the left cerebral hemisphere is much more frequently invaded than the right, because the blood-current is more direct to that side through the left carotid artery, which springs immediately from the aorta. The resulting paralysis may be a hemiplegia, a monoplegia, or an aphasia, according to the individual arterial trunk or branch which receives the embolus. A quite large proportion of the cases of "puerperal paralysis" reported appear to have been aphasia, or loss of power of word-thinking, depending, doubtless, upon the stoppage of the vessel which supplies the cerebral cortex about the island of Reil and the posterior part of the third frontal convolution on the left side. Poupon[1] has written a special paper on "puerperal aphasia," but to show how free the admission is to this class for all kinds of cases, he quotes a case of aphasia alleged to be caused by fecal accumulations and said to be cured by their expulsion. Cazeaux calls attention to the alleged fact that most paralytics reported in obstetric practice have recovered before or after delivery. This is a broad statement, and appears to me doubtful; but it does seem to be a fact that very many of these cases have been reported as improving. It may be, as already seen, that a proportion of hemiplegics and aphasics reported after labor have been hysterical. I have certainly heard by common report of complete cures of puerperal hemiplegia which do not admit of any other interpretation, because the prognosis of hemiplegia caused by either embolus or cerebral hemorrhage is not good for complete cure. No valid reason can be urged why this rule should not hold true in puerperal cases with the same lesions; in other words, the pregnant or puerperal woman with a clot or embolus in her brain has no better chance of recovery than a man or a non-puerperal woman who has suffered this accident. In this connection it may be proper to call attention to some of the distinctions of hysterical hemiplegia. In this affection the paralysis of the leg is worse than that of the arm, while the face is little if any affected. Hemianæsthesia is apt to coexist along with more or less complete paralysis of the special senses. Stiffness may occur, but is not quite as marked as the secondary contractures of genuine hemiplegia. Exaggerated knee-jerk is not marked and true ankle-clonus is not observed in hysteria. Mental and moral symptoms of a characteristic kind are apt to be observed, while if the speech is affected it is not improbably an aphonia rather than an aphasia. Hysterical or simulated aphasia, however, has been observed. Bed-sores are not common in hysteria.

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[1] "Des Paralysies puerpérales," *Mém. de l'Acad. Imp. de Méd.*, tom. xxv.

In the days when uræmia was first recognized as a result and complication of pregnancy it was not uncommon to consider it a cause of the hemiplegia sometimes happening during gestation or the puerperium. In fact, it seemed about to take the place which the lochia and the milk had formerly occupied in the humoral pathology, and to have ascribed to it all the nervous accidents, as convulsions, paralysis, and even insanity, which were formerly attributed to a suppression of those fluids. Eclampsia is doubtless of uræmic origin, but paralysis, as hemiplegia or other variety, must certainly be very rare as a lasting result of the acute nephritic disorder which sometimes complicates pregnancy and labor and produces convulsions. I am not prepared to say that lasting paralysis has never happened after eclampsia, but if so it must have been caused by some unusual damage to the cerebral blood-vessel system due to the violence of the convulsive excitement. It is quite different, of course, in cases of long-standing Bright's disease, in which arterial degeneration may have occurred. Hemiplegia as a result of such arteritis is not uncommon, and may of course occur in pregnant women if their kidneys have long been the seat of disease; and in such cases the pregnancy or labor, because of the strain it puts upon the arterial system, may be the direct exciting cause of the mishap. Such a hemiplegia would not necessarily be preceded by a convulsion.

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[1] *L'Éncéphale*, 1885, p. 393.

Inflammation of the spinal meninges has probably occurred in some puerperal cases and caused paralysis of the lower extremities. This complication is possibly of septic origin. Something like it has been observed in the lower animals. Churchill, in his paper already mentioned, quotes instances from veterinary writers of cows and mares suffering with paraplegia following the onset of a metritis. The inflammation in these instances spreads from the womb to the spinal canal, probably by the connective tissue, vessels, or, as some have supposed, by an ascending neuritis. If of septic origin it is purulent. The symptoms of spinal meningitis are those, first, of irritation. Pain is felt in and along the spine and radiating around the body, giving the constriction sense, and along the limbs. The muscles of the back are apt to be tense and rigid, and those of the legs weakened on voluntary movement, but much excited in their reflexes. If, however, the inflammation involves the lumbar enlargement, the reflexes are abolished and the muscles flaccid. Paralysis of the bladder may cause retention of urine, or reflex irritation of it may cause occasional incontinence. Hyperæsthesia is often present. The symptoms, second, are those of weakness, as have been already indicated—*i.e.* loss of power on volition. The reflex arc for the legs passes through the lumbar enlargement; hence if this is invaded the reflexes are abolished, and, the bladder being paralyzed, retention, with possibly dribblings of over-flow urine, occurs. If the anterior horns of the gray matter or the anterior nerve-roots are involved, rapid wasting of the muscles follows.

We have finally to consider the paralysis which results from injury to the sacral plexus or the sciatic nerve, caused by pressure of the child's head during its passage through the pelvis. There can be no doubt that this accident occasionally happens, because authentic cases of it are on record; and when we consider the anatomy of the parts, the wonder arises that it does not occur more frequently than it appears to. I have not made an extended search of the literature to determine, if possible, this frequency, but I have been somewhat surprised to find in a cursory view of this subject that the *relative* number of cases must be very small. Imbert-Gourbeyre thinks trauma during labor very rare as a cause of paralysis. He gives three cases which seem to have been due to pressure of the head on the sciatic nerve. Ramsbotham also refers to such cases. Women not unfrequently complain of pains shooting down the legs during labor when the head is well engaged in the pelvis, also of very severe and painful cramps in the muscles of the thighs and legs. These pains are doubtless due to pressure of the head upon the nerve-trunks or plexus, and the cramps may possibly be caused by pressure upon the blood-vessels in addition. I have never observed any persistent weakness in the legs in these cases, although I have looked for it. It is just possible that slight transient weakness of one or both legs in the puerperal woman may be overlooked occasionally, because the patient is kept so carefully at rest in bed during the first two weeks. A mild pressure-palsy could recover in that time, as I have seen it do in other parts. Paresis has been reported after short and comparatively easy labors, as well as after severe, protracted, and instrumental deliveries. From an actual dissection of the pelvis made recently, by the kindness of Dr. Deaver in the University of Pennsylvania, it appears to me, from the position of the sacral plexus, that posterior positions of the vertex would be most likely to produce a pressure-palsy. I do not know whether clinical observations confirm this.

Dr. F. X. Dercum has given me the following details of an interesting case of atrophic paralysis following labor: A woman about twenty-five years of age suffered with pain and weakness of the right leg after an instrumental delivery. This confinement was followed twenty months later by another, also instrumental and very difficult. Complete palsy of the right leg, except perhaps the anterior thigh-muscles, now followed. Two years later marked wasting with contractures of the muscles of the affected leg was present.

The symptoms of a pressure or traumatic lesion occurring during parturition are apt to be both sensory and motor: they are, in fact, the symptoms of a neuritis, which is the pathological state probably in these cases. Along with the paralysis wasting of the muscles occurs. If the sacral plexus and the small sciatic nerve are involved, paralysis of the gluteus maximus is present, causing difficulty in rising from the sitting position, and producing anæsthesia of the mid-region of the back of the thigh and the upper part of the calf. If the trunk of the large sciatic only is involved, paralysis of the flexors of the leg and of the muscles below the knee, with loss of sensation over the outer part of the leg, most of the dorsum of the foot, and all of the sole, is present. These regions of anæsthesia are those indicated by Gowers,[1] and are according to the distribution of the sensory nerves to the parts, except, in addition, that the small sciatic nerve supplies with sensation the perineum. Other branches of the plexus supply some of the smaller and deeper-seated muscles of the pelvis and buttock. The anterior crural and the obturator nerves also have, so it is said, been injured in parturition; but the position of the anterior crural certainly does not expose it to as much risk as in the case of the great sciatic. It supplies the extensors especially of the leg (the anterior thigh-muscles) and the skin of the front and both sides of the thigh, and the inner side of the leg. Paralysis of motion and sensation in these parts would therefore be caused by injury to this nerve; also—a very significant symptom—abolition of the knee-jerk. The obturator nerve supplies the adductor muscles especially of the thigh, the paralysis of which prevents the patient from crossing the affected leg over the other. It occasionally supplies a sensory filament to the inner aspect of the thigh. More minute studies of these nerve-distributions may be made, but the above is at least a practical, applicable knowledge, and if once appreciated may occasionally assist the obstetrician to an early recognition of a very unfortunate complication. Dr. Howard A. Kelly informs me that he has observed sciatic pains persist after the puerperium, the true nature of which pains had been overlooked. By digital examination through the rectum he has made pressure upon the nerve-trunk or plexus in these cases, the patients always exclaiming at once that the seat of pain was under the finger. The atrophy of the muscles which occurs in neuritis is according to the well-known law that when a muscle is cut off from its trophic centre in the spinal cord it wastes: it will while wasting present certain changes in its reactions to electricity known as the reactions of degeneration. These phenomena still further assist the diagnosis, but must be studied in special works on the subject.

As a practical point, it may be well to state that a number of observers have recorded that women who have suffered a hemiplegia of cerebral origin during pregnancy have passed through their labors happily and without any special difficulty due to their impairment. The treatment of these various lesions, when treatment is applicable, must be sought in works on diseases of the nervous system.

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[1] *Op. cit.*, vol. i.

THE MANAGEMENT AND THE DISEASES OF THE NEWBORN INFANT.

BY J. LEWIS SMITH, M. D.,

NEW YORK.

THE management of the newly-born infant at birth has been fully treated of in Volume I. It remains for us to consider the subsequent care of the infant and the diseases to which it is liable during the first weeks of life.

CARE OF THE INFANT.

ALIMENTATION.—The natural mode of feeding—that is, by the mother's milk—should always be recommended unless in those exceptional instances in which mothers are incapacitated by physical ailments or mental derangement. The common practice in wealthy families of employing wet-nurses, in the belief that suckling their infants deprives mothers of social enjoyments, and by the drain upon the system impairs their general health, should be discouraged. Wet-nursing by the mother, if properly regulated, with sufficient undisturbed sleep at night and with the maintenance of good appetite and digestion, does not impair her health, but, on the other hand, as shown by Dr. Joseph E. Winters and others, tends to promote her physical well-being. On the other hand, mothers seriously sick, unless their maladies be of short duration, should not suckle their infants: disastrous consequences follow if they attempt it. Mothers with phthisis, cancer, or other organic disease which impairs the general health or diminishes the appetite should never be allowed to wet-nurse their babies. Wet-nursing under such circumstances aggravates the disease, and the milk which such mothers furnish, even if sufficient in quantity, is deficient in nutritive properties.

Under ordinary circumstances the infant requires no food but the mother's milk until the age of six months, after which it is proper, and often necessary, to give some additional nutriment, since at this time the mammary secretion begins to diminish.

The baby should take the breast when the mother has recovered from the fatigue of her confinement, or in about six hours after birth. It may be applied to the breast every hour when the mother is awake until the age of three weeks. The milk is not secreted in quantity sufficient for nutrition until the third day, but there is a prior secretion of colostrum which the baby receives, and which by its laxative action aids in the expulsion of the meconium. The early application of the child to the breast has this beneficial effect—that it promotes the mammary secretion and renders it less difficult for the infant to grasp the nipple when the breast is distended with milk. The very common practice of untrained nurses and female friends of giving to the baby various sweetened mixtures as soon as it is born, and administering them from the first day onward whenever it frets, in the belief that it is hungry or that it has colic which fennel, catnip, or aniseed with sugar will relieve, should be forbidden. The child thus treated soon has stomatitis with sprue. It nurses less frequently, and is more fretful on account of its distended stomach and sore mouth, and the mother's breasts, lacking the proper stimulation, yield less milk. The infant will not suffer if fed nothing but the scanty mammary secretion until the third day. At and after the third day, if the supply of milk be inadequate, the deficiency may be supplied for a few days by the use of one part of selected cow's milk and three of water, with the addition of a little lime-water. Cow's milk, however fresh, is acid, while human milk is alkaline.[1] Hence the addition of lime-water sufficient to produce alkalinity.

The preference must always be given to the mother's milk if she be well, and only that amount of cow's milk should be given every fourth hour as will supply the deficiency. The great majority of mothers need no such aid in nourishing their infants, and artificial feeding, when it is not required, is pernicious. Over-feeding of young babies, as well as of those who are older, results disastrously in producing indigestion, colic, diarrhœa with unhealthy stools, and sometimes gastro-intestinal catarrh, with subsequent loss of flesh and strength. It is important that the accoucheur should have clear and definite knowledge of the amount of nutriment required by the newborn infant.

A few years since Drs. Chadbourne, Parker, and myself made observations in the New York Infant Asylum and New York Foundling Asylum in order to determine how much food children required at different ages. Those selected for observation were well nourished, and they were accurately weighed before and after each nursing or feeding during twenty-four hours. Eleven infants under the age of three weeks, who took the breast, with three exceptions, twelve times in the twenty-four hours in which they were under observation, were found to take in the average, during the day, 12.55 ounces, as seen by the following table:

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[1] In two localities in Central New York the milk of 27 healthy pasture-fed cows was tested, at my request, by litmus-paper at the time of the milking, and in every instance it was slightly acid.

No.	Name.	Age.	No. of Nursings.	Milk Nursed in 24 Hours.		
				Quantity in Weight.		Quantity in Fluidounces.
				Oz.	*Dr.*	
1	Josephine Foley	17 d.	11	10	½	9.75
2	Henry Cunningham . . .	16 d.	9	13	5	13.24
3	Henry Jackson	19 d.	9	10	3	10.07
4	—— Rake	5 d.	12	22	7	22.22
5	Henry Benton	6 d.	12	15	5½	15.25
6	Wm. Fletcher	5 d.	12	10	1½	9.88
7	Nora Hastie	14 d.	12	17	3	16.85
8	Carl Flask	5 d.	12	5	4	5.37
9	Clarence Humphrey . . .	1 m. 5 d.	8	11	1½	10.84
10	Frederick Dighle	7 d.	12	14	4	14.08
11	Edward Stace	6 d.	12	8	1	7.74
12	Rosa Brown	3 w.	12	14	1	13.68

Rotch[1] has endeavored to ascertain the normal capacity of the stomach in infancy. A difficulty arises in such examinations on account of the distensible state of the stomach in young infants, but he states that this organ at the age of five days holds only six and a quarter fluiddrachms without distension. The stomach of the young infant appears, however, to increase in size and capacity more rapidly than the system generally. Thus, according to Frowlawsky, if 1 represents the growth in the first week, $2\frac{1}{2}$ represents it for the fourth week, $3\frac{1}{5}$ for the eighth week, $3\frac{1}{3}$ for the twelfth week, $3\frac{4}{7}$ for the sixteenth week, and $3\frac{3}{5}$ for the twentieth.

Ssnitkin of St. Petersburg has prepared a formula for determining the quantity of food required by young infants, which he believes to be a safe and reliable guide. It is based on the weight of the infant. According to his observations, the greater the infant's weight the greater is the capacity of the stomach; and he believes that the infant at birth requires one one-hundredth part of its weight of food properly prepared and of proper consistence for each feeding, and 1 gramme or 15 minims in addition should be added each day. Thus, if the infant at birth weighs 6¼ pounds or 100 ounces, it requires 1 ounce at each feeding; on the second day it requires 1 ounce and 1 drachm; on the third day, 1 ounce and 2 drachms, etc.

Rotch[2] has prepared the following table to indicate the amount of food required at each feeding, according to the age:

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[1] *Arch. of Pediatrics.*

[2] *Ibid.; Annual of Univer. Med. Sci.*, vol. iv., 1888.

Age.	Intervals of Feeding.	Average Amount at each Feeding.	Average Amount in 24 Hours.
1st week	2 hours .	1 ounce . .	10 ounces.
1–6 weeks	2½ " .	1½–2 ounces . .	12–16 "
6–12 weeks, and possibly to 5th or 6th month	3 " .	3–4 " . .	18–24 "
At 6 months	3 " .	6 " . .	36 "
" 10 "	3 " .	8 " . .	40 "

It is seen that the estimates by Drs. Ssnitkin and Rotch agree nearly with the observations made by myself as regards the amount of food required by infants under the age of two or three months; but the food, in order to have these estimates correct, should have the consistence and nutritive properties of human milk. When, as is sometimes the case, too large a proportion of water is added through the ignorance or carelessness of the nurse, of course the quantity required would be greater than when the proper amount of water is employed, and the stomach might be temporarily over-distended; but the excess of water is quickly eliminated from the system through increased urination or thin and more frequent stools.

The above statistics correspond with those of other observers. They show that infants under the age of three weeks take, on the average, about half the milk required by those over the age of two or three months. After the third week the amount required for healthy nutrition increases with the progressive growth of the infant.

If for any reason the mother be unable to suckle her infant, of course some other provision must be made; but many mothers are discouraged by trivial causes, and will resort to bottle-feeding when by a little patience and encouragement they might perform fully the duties of wet-nursing. The physician should encourage the mother disheartened by the pain of sore nipples or temporary indisposition to persevere in suckling her infant, unless her condition be such that wet-nursing is impossible without risk of injury to herself or the child. By the close of the second or third week her ability or incapacity for wet-nursing will be apparent, and if she be incapable of the task a wet-nurse must be employed or artificial feeding resorted to. In the city the preference should be given to the wet-nurse if one with proper qualifications can be obtained and the family can incur the expense; but in the country it is probably better to employ artificial feeding, and it is often necessary in the city on account of the expense and difficulty of obtaining proper wet-nurses. Therefore how to feed a baby deprived of the breast milk is one of the most important problems which the physician is called upon to consider.

Dr. Arthur V. Meigs recommends the following food as a substitute for breast milk: "One quart of milk is placed in a vessel—a tall, narrow pitcher is best—and after standing for three hours the upper pint is slowly poured off. This contains the greater part of the fat (cream), and when the child is to be fed there should be mixed together three ounces of this cream, two ounces of lime-water, and three ounces of sugar-water, which must be made in the proportion of eighteen drachms of milk-sugar to one pint of water. This makes eight ounces of food, which of course is much too large an amount for a young infant or one that is ill. If, therefore, the infant is young, only two to four ounces will be needed at each feeding, and only that quantity should be prepared," the proportions mentioned above being preserved. "The directions given are those for the feeding of a healthy infant between two weeks and six to nine months of age."[1]

Whatever food is employed, cow's milk must in this country be its basis, and the utmost pains should be taken to secure good milk. The milk of stabled cows in or near the city should be discarded, and that obtained from dairies in the rich farming sections should be used. Cows that have the range of pastures and feed upon grass and clover, and in the summer months lie upon the grass, and in the winter have clean stalls and plenty of straw to lie upon, have better health, cleaner udders, and furnish better milk than the constantly-stabled cows in the city, or those with limited and scanty pasturage in the city suburbs. The dairymen should be required to follow strictly the excellent rules prepared by Prof. Vaughan for the care of the cows and management of the milk. Inquiry should be made if the cows have pure drinking-water, if noxious weeds are removed from the pastures, if no decaying cellar or kitchen refuse be fed them, and their udders are clean at the time of the milking.

Not less important is the management of the milk. Scalded and clean milk-pails and milk-cans should be employed, and immediately after the milking the uncovered pails or cans should be placed in cold running water or surrounded by ice, so as to remove the animal heat and reduce the temperature to sixty-five, or better to sixty, degrees. The milk should then be covered, and except in the coldest weather should be constantly surrounded with ice until it is delivered in the family. Milk is a culture-medium for different species of microbes which happen to alight in it. It is believed that the microbes of diphtheria and scarlet fever are propagated in it, and epidemics of these diseases have apparently been traced to the milk employed. How many other pathogenic microbes may be propagated in milk we are unable to state. Milk, therefore, bottled at the farm is safer for use than that served in open cans, especially in the city, the air of which contains numerous species of micro-organisms.

The importance of removing the animal heat from milk in open vessels immediately after the milking by surrounding them with cool running water or ice, and of subsequently maintaining the milk at a low temperature (60° to 65° Fahr.), has been shown by many instances of deleterious results when milkmen have neglected to treat milk in this manner. Upon a hot day in 1886 milk from a mid-day milking from healthy and well-fed cows was transported, in its warm state and in closed cans, a distance of eight miles to Long Branch. In the short time of seven hours, under the influence of animal and atmospheric heat, a poisonous ptomaïne, the tyrotoxicon, was developed in the milk, so that the guests of two hotels who partook of the milk in the evening of the same day were poisoned by it, presenting all the symptoms of a choleraic disease. No one can tell how many children have perished from a similar cause—how many cases of fatal cholera infantum have had a similar origin.

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[1] *The Med. News*, July 7, 1888.

Many families are impressed with the belief that milk from one cow is preferable for infant feeding to the mixed milk of the dairy, and they pay a higher price and are sometimes greatly inconvenienced in order to obtain it. Much deception is practised in this matter of obtaining one cow's milk. In New York a female vender of milk said to be from one cow was detected in obtaining her morning supply from the common stock of inferior milk at a corner grocery. But even if the milk be from one cow having the ordinary care and feeding, it is usually more variable than, and does not present so good an average as, the mixed milk from a healthy dairy. The mixed milk is therefore to be preferred.

Our present purpose is to advise in reference to the feeding of newborn babies, but a physician who attends in the parturient state is expected to give advice in reference to the subsequent feeding. If for any reason an infant be deprived of human milk, and be from necessity placed upon cow's milk, the following will be approximately the dilution required at different periods of infancy (the water employed should be boiled in order to destroy any microbes present in it; water which has been distilled is preferable to other kinds): Until the age of three weeks, one part of milk to three of water; from three weeks to six weeks, one part of milk to two parts of water; from six weeks to three months, two parts of milk to three of water; at three months, half milk and half water; at six months and subsequently, three parts of milk and one of water.

In 1881 a conference was held in Salzburg, Germany, of physicians from various parts of the German Empire, known throughout the world as specialists in the diseases of children. The purpose of the convention was to discuss the diet of infancy and childhood. They agreed that animal milk is the best substitute for human milk in the feeding of infants, either as the main food or as the basis of the food employed.

The experience of physicians in all countries shows the soundness of the opinions expressed by the conference, and yet feeding with animal milk of the best quality must be carefully managed or it will be found to disagree with the feeble and readily-disturbed digestive functions of the infant. Employed habitually too hot or too cold, it frequently causes stomatitis or a more serious disease of the digestive organs. It should be given at a uniform temperature of about 99°. Infants under the age of ten months should nurse from the nursing-bottle, and this as soon as used should, with the india-rubber tip and attachment, be immersed in a two-quart bowl of cold water to which two teaspoonfuls of sodium bicarbonate have been added; and this alkaline water should be drawn through the tube and nipple by suction with the mouth.

Cow's milk, though possessing nearly the same composition as human milk, nevertheless behaves differently in some respects in digestion. The casein of human milk coagulates in light flocculi in the stomach of the infant, so as to be readily acted on by the digestive ferment, pepsin, while that of cow's milk forms firm and large coagula which are digested with difficulty. A food which is imperfectly digested, and which in part undergoes fermentation, becomes the nidus for the development of many forms of bacteria and ptomaïnes, which frequently cause gastro-intestinal irritation and catarrh. This condition gives rise to fretfulness, colic, vomiting, diarrhœa, or unhealthy stools and loss of flesh and strength. Cow's milk is digested with difficulty by young infants who have a feeble digestive function. Therefore the profession has long felt the need of some modification of cow's milk, so that it may resemble more closely human milk when acted on by the digestive ferments. This has in a measure been accomplished by the process known as peptonizing, by which the casein is digested, or so far digested that it coagulates in flakes.

At the meeting of the Salzburg conference alluded to above a distinguished physician present recommended the peptonizing of milk for infant feeding, and this process apparently met the approval of the conference. Milk is peptonized by the action on it of extractum pancreatis and sodium bicarbonate. Messrs. Fairchild Bros. & Foster of New York have simplified the process of peptonizing, and prepared the agents used for this purpose, so that the change in the milk can be readily effected in the nursery at the time of each feeding. We may here briefly state the method: A powder containing five grains of extractum pancreatis and fifteen of sodium bicarbonate is put in a clean quart bottle, and a small teacupful of cool water is added and shaken. Then a pint of cool milk is added and the mixture shaken again. The bottle is then placed for twenty minutes in water at such a temperature that the whole hand can be held in it for a minute without discomfort. Then the bottle is surrounded with ice to prevent further peptonizing.

By peptonizing is accomplished what physicians have long felt the need of, especially in the feeding of newborn babies whose digestive function is feeble—to wit, a mode of preparing cow's milk so that its casein coagulates in flakes like that of human milk. Milk employed for peptonizing and for the feeding of newborn infants should of course be as fresh as possible, but, unfortunately, much of the milk delivered in the cities is twenty-four hours old when received, and if the weather be hot, instances are not infrequent in which it has begun to undergo fermentation, and is of course unsuitable for infant feeding, whether peptonized or manipulated in any other way. This is one of the chief reasons why in city practice the use of peptonized milk not infrequently disappoints our expectations. The peptonizing of milk rests on a scientific basis, and as clinical experience has demonstrated the usefulness of milk prepared in this manner in the feeding of newborn infants, and in those who are older, as well as invalid adults, it will probably continue to be used as one of the best substitutes for breast milk.

In New York City, from the fact that much of the milk dispensed in families is unsuitable for infant feeding, especially in the warm months, when fermentation begins early, the condensed milks have come into extensive use. The canned condensed milks contain too much cane-sugar (nearly 50 per cent.) for ordinary use in the nursery. The habitual employment of this milk for an infant remaining in the city during the hot months is likely to result disastrously in the production of that fatal disease, the summer diarrhœa, and the newborn are even more liable to it than those who are older. In any season the newborn infant whose food contains 50 per cent. of cane-sugar is very prone to contract spruc, in addition to gastro-intestinal catarrh. Although the canned condensed milk should not be recommended for habitual use for the reason stated, the fresh condensed milk dispensed daily—if, as is true with at least one of the companies, the health, feeding, and milking of the cows, and subsequent management of the milk before and after condensation, are under close surveillance—is free from the objections mentioned. The use of all condensed milks is condemned by certain good observers, but fresh condensed milk prepared by a careful and painstaking company is preferable for infant feeding to ordinary milk, which has been badly managed, and in which we can detect commencing fermentative changes. Such milk is not infrequently dispensed in New York, especially among the poorer families and in the hot months. I could cite instances in which the change from the use of the ordinary milk to condensed milk was very advantageous to infants. For an infant under the age of three weeks one part of condensed milk should be mixed with fifteen parts of boiling water, and a little salt added. As the child grows older the proportion of milk should be increased. The bad result obtained by physicians in the employment of fresh condensed milk is, in my opinion, largely due to erroneous directions given in reference to its dilution. Even physicians of large experience often give loose and faulty directions. I have many times examined infants suffering from innutrition, and been told that one teaspoonful of condensed milk was added to a teacupful of water; and in one recent instance in which a young infant had marasmus the family physician stated that it had been fed with condensed milk, one teaspoonful to a pint of water, by his direction. The patient had scanty stools, but very abundant urination. One who prescribes condensed milk should recollect that it differs from ordinary milk in the fact that about 75 per cent. of its water is removed under vacuum, so that it requires the addition of only three or four times its quantity of water to restore the original proportion of this ingredient.

The newly-born infant usually thrives for a time by the use of cow's milk when of good quality and prepared as recommended by Dr. Meigs or by peptonizing. As long as it agrees with the feeble digestive functions of the infant, milk prepared by either of these processes may be indefinitely employed, either to supplement the wet-nursing when the mother's milk is inadequate, or as the sole food when weaning has been necessary. But in the cities, where the cow's milk dispensed in the morning is from twelve to twenty-four hours old, and especially in the hot months when fermentative changes in the milk occur early, a certain proportion of infants thus fed begin to suffer from indigestion, colicky pains, vomiting, diarrhœa, and stomatitis, and it becomes a very important duty on the part of the physician to suggest such change in the kind of food or in its preparation that it will be more easily digested and be sufficiently nutritious.

Chloride of sodium aids in the digestion, and it should be added to the diet of the infant in sufficient quantity to be slightly tasted. It is believed to stimulate the follicles that secrete the digestive ferments, and it is said also to have a tendency to prevent in a measure the heavy and solid curds of casein which are digested with such difficulty by young infants. Therefore common table-salt is a very important addition to the dietary of the nursery.

We have stated above that whatever food artificially prepared is employed in the feeding of infants, animal milk, and in this country cow's milk, must be its most important ingredient, and measures have been employed to render it more digestible by young infants with a degree of success. The fact has long been known that one of the farinaceous foods, as barley flour mixed with milk, tends by mechanically separating the particles of casein to prevent the formation of hard and firm curds in the stomach. But starch is digested with difficulty and in small amount by infants under the age of three months. The salivary glands and the pancreas, whose secretions digest starch, are almost rudimentary under the age of three months, and the digestive ferments which they secrete therefore aid but little in the starch-digestion. The oral and intestinal secretions aid a little, but very inadequately, in the transformation of starch. Therefore the cereals which contain from 60 to 70 per cent. of starch are justly considered as improper food for young infants unless the starch is predigested. It was the crowning labor in the life of the late Baron Liebig that he pointed out the way to predigest starch by the action of the diastase of malt. Starch when digested becomes, first, soluble starch, then dextrin, and finally glucose. Dextrin can be digested and assimilated by the youngest infant, and glucose or grape-sugar can be readily assimilated in the first weeks of life in any desirable quantity. Prof. A. Jacobi says: "Grape-sugar and dextrin are absorbed equally."[1]

A considerable part of the starch in the various cereals can be changed into dextrin by the prolonged action of heat, and thus a digestible form of barley or other flour can be obtained without any chemical admixture. Impressed with the importance of preparing such a flour for use in the nursery, I have induced a party to prepare and place in certain drug-stores in New York barley flour prepared as follows: The flour, dry in a dish, is suspended over boiling water seven days; it is then grated and sifted, and maintained at a temperature a little above animal heat two days longer. It is then ready for use. It has a reddish-yellow tinge from the large proportion of dextrin present. For an infant in the first month one teaspoonful of the prepared flour should be added to fifteen teaspoonsful of water, brought to a boil, and an equal quantity of peptonized milk be added, or in place of this five teaspoonsful of milk or one teaspoonful of fresh, not canned, condensed milk.

The above are proper modes of feeding newly-born babies when unfortunately deprived of the mother's milk. Many thus fed do well, but no food is so suitable for young infants as human milk when it can be obtained in sufficient quantity and from a healthy source. In addition to the salt which should always be employed in these artificial preparations, a little sugar may also be added. Grape-sugar added so as to sweeten the food will often render it more palatable, and it has a tendency to obviate any constipation which may be present.

In Volume I. p. 535, is a description of the incubator or hatching-cradle employed by M. Tarnier, and through his advice by many other physicians, in the management of weak and immature infants. But the feeding of such infants is a matter of the highest importance, for success in the use of the hatching-cradle depends largely on the alimentation.

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[1] *Archives of Pediatrics*, Jan., 1888, p. 8.

The immature infant often swallows with difficulty, and a considerable part of the food placed in its mouth flows out between the lips, and if the nutriment taken be insufficient it loses in flesh and strength. Under these circumstances gavage is employed. The infant is taken upon the lap with the head slightly raised; an urethral red-rubber catheter (No. 14–16, French), moistened, is introduced to the base of the tongue, and by the efforts of deglutition is carried down the œsophagus to the stomach. A small glass funnel is inserted in the open end, and liquid food placed in it descends into the stomach. The tube is then removed rapidly, for its slow removal is likely to produce vomiting. For small, premature infants about two to three fluiddrachms of the mother's milk should in this manner be introduced into the stomach nearly every hour. If her milk cannot be employed, the milk of a wet-nurse or peptonized milk may be used instead. If the amount of nutriment administered in this way be too abundant, the child may increase in weight and size, but it is from œdema, which disappears when the proper amount of nutriment is given. If excessive feeding be continued, indigestion results, followed by gastro-intestinal catarrh, which may be fatal. If the infant gain in strength, it should be applied to the breast as soon as it is able to grasp the nipple, but it is usually best to employ the gavage mode of alimentation three or four times daily (*gavage de renfort* of Tarnier) even when suckling is possible until the infant becomes stronger and can draw the breast milk like infants that are vigorous and born at term. By the use of the hatching-cradle and alimentation by gavage infants born as early as the sixth month have been viable.

Effect of Medicines on the Mother's Milk.—This important subject has been investigated by Fehling.[1] According to him, one to two grammes of salicylate of sodium taken by a woman who is wet-nursing may be recovered in part in the child's urine. Rheumatism in the nursing child may therefore be treated by the ordinary doses of this agent administered to the mother. Rheumatism occurs more frequently in the nursing infant than is commonly supposed, since its symptoms as regards the joints are commonly mild and likely to be overlooked; and it often causes endocarditis and permanent valvular disease. Schaeffer[2] relates the case of an infant born with rheumatism. Iodide of potassium also, says Fehling, given to the mother may be detected in large quantity in the infant's urine. Fehling has made the following observations: Ferrocyanide of potassium is eliminated in the mother's urine, but not in the child's. Its quantity in the milk of the mother is very small. After applying iodoform to perineal lacerations, iodine was found in the milk and urine of the mother, and sometimes, but not always, in the infant's urine. No apparent harm to the infant occurred in any instance from applying iodoform to the mother during the period of lactation. When mercury was taken by the mother it did not usually appear in the milk. A solution of citric acid, one part to ninety, given for four days, the quantity not exceeding three grammes, did not produce any perceptible change in the milk. The same was true of the administration of acetic and hydrochloric acids. Fehling concludes from his observations that acid foods, as salads, need not to be withheld from nursing women, at least so far as there is risk of producing the secretion of acid milk. Twenty-five drops of laudanum given to the mother in no instance caused drowsiness, constipation, or any other ill effect in the nursing infant. Morphia given hypodermically did not, as a rule, appear to affect the child, but in one or two instances it slept rather long. On the other hand, atropine taken by the mother caused dilatation of the pupils of the child. Chloral hydrate given in as large a quantity as twenty-three to forty-six grains in no instance produced symptoms in the child.

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[1] *Arch. f. Gyn.*, xxvii. p. 332; *Journ. de Méd.*, July 31, 1887.

[2] *Berliner klinische Woch.*, No. 5, 1886; *Revue Mens.*, Apr., 1886.

The effect on the nursing child of medicines administered to the mother requires further investigation. The observations relating to it published in the journals are as yet insufficient for the valid and reliable deductions which are required by the profession to ensure safe and proper medication of the mother during lactation.

BATHING.—At birth the external and internal temperature of the infant is about the same, that of the external surface being nearly or quite as high as that of the blood. The temperature of the lying-in apartment being twenty degrees lower, a sudden reduction of the external warmth of the infant occurs unless it be immediately enveloped in a warm blanket at birth. The washing of the infant, which requires exposure, should be performed without unnecessary delay, with water at a temperature of about 94°. It is perhaps better that weakly and premature infants, who react feebly and slowly, be not bathed at all, but their surfaces be rubbed with sweet oil and wiped with a soft cloth. Indeed, it is a question whether sweet oil should not be used in all cases, instead of water, in removing from the surface of the newborn the irritating products of exfoliated epidermis and amniotic secretion. If water be employed, bathing should be expedited, the surface dried as soon as possible, and gently rubbed with a soft towel whenever the temperature of the extremities is below normal and they begin to have a livid color, for there is great danger of catching cold when the surface is chilled by the evaporation of water and does not quickly react.

When the navel is dressed no general bath is required or is proper until the detachment of the cord. During the first year after the fall of the cord the bath should be employed daily, but not longer than three minutes, during which time thorough ablution can be performed. Authorities disagree in regard to the proper temperature of the bath during the first months of infancy. Steiner of Prague, a high authority in children's diseases, says: "During the first nine months the infant should have a daily bath a little above blood-heat;" but most writers recommend a temperature a little below blood-heat. It should probably be at about 92°, which is considerably below blood-heat, but it communicates a moderately warm sensation to the hand. For vigorous children at the age of six months and subsequently the temperature of the bath may be at 90°, and it should not be lower than this during the remainder of infancy, or if it be a little lower care should be taken to produce reaction by the warmth of the room and brisk rubbing and exercise after a short bath. The rules given in the books, not to bathe a child immediately after a hearty meal or after much exercise when the surface is perspiring, should be heeded. The head should first be wet with the water, and castile soap should be applied over the surface to ensure cleanliness. The strongly scented toilet soaps sometimes contain rancid fats or other deleterious substances, and should be regarded with suspicion. In hot weather a daily bath is advisable, but in the cool months a bath twice a week is sufficient, local sponging being employed between-times to ensure cleanliness.

Clothing.—Too little attention is given by physicians to the manner in which young infants are clothed. Many errors are unconsciously committed by parents and nurses in the selection of the garments to be worn and the manner of applying them. An important principle in the clothing of children of any age is to apply the garments so loosely that, while they protect from vicissitudes of temperature and produce the necessary warmth, they do not in the least restrain the functional activity of the organs underneath. Even in the application of the first article of dress, the bellyband, harm is sometimes done, since nurses often apply it too snugly over not only the abdomen, but the lower part of the chest. I have frequently interposed to loosen not only the bellyband, but the external dressing, which was so snugly drawn as not only to compress the stomach and intestines, but also the lower ribs. Tight bandaging of the chest and abdomen is more injurious in early infancy, when the tissues are soft and yielding, than at any other age, since it may seriously impair the functional activity of both the thoracic and abdominal organs. Bandaging too snugly over the epigastric and hypochondriac regions tends to prevent full inflation of the lower lobes of the lungs by restraining the movements of the diaphragm and depressing the ribs, which are very yielding at this age. It no doubt aids in causing pulmonary collapse in cases of severe bronchial catarrh. The stomach requires full expansion and free movement in order to perform its function of digestion properly. Undue pressure upon it causes an uncomfortable sensation, fretfulness, and sometimes regurgitation or vomiting of food. The intestines and solid organs of the abdomen tolerate compression better, but their functions are more or less restrained by it. When the epigastric and abdominal covering is so snug as to cause fretfulness, loss of sleep and forcible crying, inguinal hernia sometimes results—an annoying and painful ailment to the young as well as old.

Another part where too snug an application of the dress does harm is the neck, since undue pressure in this region retards the circulation of blood through important vessels, those which supply blood to or return it from the head. The dress upon the neck should be so loose that the nurse can readily apply the four fingers underneath it. The common practice of covering the head at all times, and burying in a soft pillow even during the midsummer heat, is wrong. While the body and extremities should be warm and protected from vicissitudes of temperature by suitable clothing, the head requires different treatment. The infant is very liable to cerebral congestions, which give rise to headache and fretfulness, and which, according to M. Jules Simon,[1] though at first simply a functional disturbance, may end in serious and fatal organic disease. While, therefore, all undue excitement of the infant should be avoided, its head should be uncovered or loosely covered in the habitually warm air of the nursery. When it is taken outdoors, of course the head should be properly covered, unless during the midsummer heat.

In determining the amount of clothing which would be proper for the newly-born infant we must regard the habitual warmth of the nursery. Its temperature should never be below 70° nor above 75°, but in midsummer it will necessarily on some days be higher. It is the common practice in families to leave off the "bellyband" when the infant has reached the age of three or four months; but from the fact that it so often takes cold, especially at night, by throwing off bedclothes, both in cool weather when the temperature of the apartment may fall below 70° and in summer when there are currents of air through open windows, I advise the continuance of the band during the first year or even during infancy. It would be well if the accoucheur should recommend this before discontinuing his visits. Bronchitis, broncho-pneumonia, and sometimes, in my opinion, that fatal disease trismus, occasionally occur from the sudden exposure of the unprotected surface of the newly-born infant to cold air or to currents of air.

The bellyband in the summer should be made of light merino and in the winter of flannel, and should be secured by safety-pins or stitches. If excoriations or prickly heat appear on the skin under the band in hot weather—a very common eruption in infancy—the surface should be dusted with lycopodium mixed with an equal quantity of bismuth or oxide of zinc, and a single layer of linen should be applied over it and under the band. If the eruption be severe, it might be best to substitute a linen or soft muslin band for a time in place of the merino.

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[1] *Trans. of Ninth International Med. Cong.*

If the child have reached an age at which it is proper to take it in the open air when the weather is suitable, its head and ears should always be properly protected by covering while it is outdoors. Many a young child with scanty growth of hair has contracted that painful disease inflammation of the ear, to which infants are very liable, followed perhaps by a protracted discharge and more or less impairment of hearing, in consequence of taking cold from insufficient covering of the head and ears in inclement and changeable weather. Even leaving off accidentally for a short time a garment to which the infant is accustomed will sometimes give it a cold.

Clothing protects the body according to its thickness and the feebleness of its conducting power of heat. Woollen, fur, and feather garments have very low conducting power, and wool, from its plentiful supply and cheapness, must always be the material which is chiefly worn in the winter season; while cotton, and in still greater degree linen, are active conductors of heat, allowing its quick escape from any part of the body which it covers, and they are therefore the proper material for summer clothing. The color of a garment matters little as regards the escape of heat from the body, for, whatever its color, its surface next the body is necessarily dark from the exclusion of light; but the color is important as regards the absorption of heat from the atmosphere and solar rays. Black has the highest absorptive powers, while white has the least, and mixed colors have an absorptive power which is intermediate. In experiments made with shirtings of different colors, while white received 100° Fahr., black received 208°. A light color is therefore the best to dress infants in during the heat of midsummer.

The extremities should always be warm and dry, and care should be taken that the garments which cover them should be pliable and loose, like those of the trunk. The younger the infant the greater is the injury from undue compression of any part. The diaper should be examined frequently, and removed as soon as possible whenever soiled. By so doing erythema intertrigo, which always increases the fretfulness of the child, may in great measure be avoided.

SLEEP; EXERCISE.—The newly-born infant requires from fifteen to eighteen hours' sleep each day. It sleeps, therefore, most of the time when not awake for nursing, bathing, or change of clothing. If it do not have this amount of sleep and be wakeful, it is probably not well and requires the advice of the physician. As it grows older, a less and less amount of sleep is needed. Between the ages of three and six months about fifteen hours of sleep each day suffice, and between the ages of six and ten months twelve hours. If the child be not allowed the proper amount of sleep in the crib or cradle, it is likely to fall asleep on the sofa or floor, or in places where it is liable to take cold from currents of air or scant covering if not heeded.

Much harm has been done to young infants who were wakeful by nurses, and mothers too, who have given them active and dangerous drugs as laudanum or morphine under some enticing name as "soothing syrup" or "cordial." A fretful infant deprived of the needed sleep is not well: its ailment is probably trivial, but it may be grave. It should never, under such circumstances, receive any of those proprietary mixtures having seductive names which the shops contain. If it need medicine, it should be examined and prescribed for by the physician.

It is perhaps unnecessary to state that free ventilation and the utmost purity of the air are requisite in the nursery, so far as they can be obtained without exposure to draughts of air and without the reduction of the temperature below 70°. Overcrowding in the sleeping apartment must be studiously avoided. Curtains should not, as a rule, be employed, and no open vessels containing foul water should stand in the room, or anything that may contaminate the air.

Exercise promotes the general health and bodily development at all periods of life, and when not excessive it should not be restrained. The newly-born infant has its mode of exercise in the movements of its head and limbs and in the vigorous outcries which inflate the lungs and develop the respiratory muscles. Free movements of the limbs should be encouraged even in the youngest infants. In some European countries, in families of the laboring class, who have little knowledge or thought of hygienic requirements, it is the common practice to surround the body and limbs with a pillow reaching from the head to the feet or with two or three thicknesses of coarse, heavy flannel, and prevent the escape of the imprisoned arms and legs by winding over them a strong tape or a cord. The victim of this barbarous practice lies for hours, day after day, unable to move any part except the head. The effect of such treatment and faulty management in other respects is to produce or develop an unhealthy state of the system. Most of the cases of rachitis in the American cities occur in the families which have emigrated from those European countries where the infants are treated in this manner, and who in this country continue the absurd practice. Fortunately, in families of American parentage, even among the poor and ignorant of the tenement-house population, and among the intelligent whatever the nationality, better practices prevail, and the result is a more healthy development of the limbs and bodies of infants.

An infant before he is old enough to stand takes sufficient exercise in a way that is natural and harmless. Let him lie upon his back in the crib or upon the floor, with a blanket under his body and a pillow under his head, with his clothes loose, so as not to restrain the free movements of his limbs. A healthy infant enjoys this liberty, moving all his limbs sufficiently to give them the required exercise, and evincing his delight and the exuberance of his emotions by utterances which are as expressive as words.

In the cool months of our latitude infants should not be taken outdoors until the age of three months, and then only for a brief time in the warmest part of the day; but in the hot months of summer they should begin to receive outdoor air and exercise at the age of one month. In warm weather the face should not be covered with a veil or otherwise, and air and light should have free access to it. The rays of the sun, however, from a clear sky in the hot months should be excluded by a parasol or the shade of trees or houses, or by the carriage top. In cool weather or when there is wind the protection of a veil is needed. Rude tossing of infants, which is common in families, should always be forbidden. Its effect on the cerebral circulation is likely to be bad, and it involves risk of serious accidents. In one instance to my knowledge death resulted in this way. With the ordinary hired nurse it is safer for the baby to be taken out in a baby-carriage than in the arms, for if the nurse in walking should trip great harm might result. In one instance in my practice convulsions and idiocy were plainly referable to the fall of an infant from its nurse's arms upon its head. The nurse should always be instructed to handle the infant gently. Several instances have come under my observation of paralysis of the arm due to stretching of the brachial plexus, produced by lifting the baby by the arm—a highly censurable practice and one which justifies the dismissal of the nurse. Fortunately, the paralysis is not permanent.

MALFORMATIONS.

The theory that vivid mental impressions experienced by the mother during gestation may arrest or render abnormal the development of the fœtus appears to be fully established by clinical observations. Many cases are on record in which infants were born with marks or deformities corresponding in character with objects which had been seen and had made a strong impression on the maternal mind at an early period in gestation. Facts indicating that the mind of the mother exerts a controlling influence on the development or growth of the fœtus are interesting to the psychologist as well as physician, since they indicate the power and scope of the human mind. That strong emotions may powerfully affect the functions of most of the important organs in the system is well known. They may derange the liver, causing jaundice; accelerate or for a moment suspend the heart's action; stimulate the kidneys, causing diuresis, or even the intestinal follicles, causing watery evacuations; but with all these organs the brain is connected by nerves which anatomy reveals. On the other hand, the mother and fœtus have a distinct existence as regards their nervous systems, and even their blood. Still, the multitude of facts which have accumulated justify the belief that deformity or arrested development of the fœtus is at times due to the emotions of the mother. Some of the cases related by Dr. Whitehead in his treatise on hereditary diseases are very interesting, and difficult to explain on the ground of coincidence. I have met the following cases: An Irish woman of strong emotions and superstitions was passing along a street in the first months of her gestation, when she was accosted by a beggar, who raised her hand, destitute of thumb and fingers, and in "God's name" asked for alms. The woman passed on, but reflecting in whose name money was asked, felt that she had committed a great sin in refusing assistance. She returned to the place where she had met the beggar, and on different days, but never afterward saw her. Harassed by the thought of her imaginary sin so that for weeks, according to her statement, she was made wretched by it, she approached her confinement. A female infant was born otherwise perfect, but lacking the fingers and thumb of one hand. The deformed limb was on the same side, and it seemed to the the mother to resemble precisely, that of the beggar. In another case which I met a very similar malformation was attributed by the mother of the child to an accident occurring to a near relative which necessitated amputation during the time of her gestation. I examined both of these children with defective limbs, and have no doubt of the truthfulness of the parents. In May, 1868, I removed a supernumerary thumb from an infant whose mother, a baker's wife, gave me the following history: No one of the family, and no ancestor, to her knowledge, presented this deformity. In the early months of her gestation she sold bread from the counter, and nearly every day a child with double thumb came in for a penny roll, presenting the penny between the thumb and the finger. After the third month she left the bakery, but the malformation was so impressed upon her mind that she was not surprised to see it reproduced in her infant.

Mrs. S——, West Fiftieth street, New York, when in the seventh week of gestation saw a child with fingers united, so that they resembled the palm of the hand extended. She was much excited at the appearance, and clutched the window-sill with such force as to cause abrasion of the fingers. The malformation of the child made a deep and lasting impression on her mind, and her child, born at term, had the index, middle, and ring fingers of the left hand webbed and ending with the first phalanges, while the little finger was normal. Mrs. D——, Eighth Avenue, New York, seven months before the birth of her child, when visiting her friends at a distance, accidentally broke the plate of a full set of upper teeth. The fracture was through the centre and antero-posterior. Being away from home, she was much annoyed by the accident, and retained the fragments of the plate *in situ* by pressure with her tongue. As she could not open her mouth without the plate falling out, except it was retained by pressure with the tongue, her mind was dwelling almost constantly on the accident during the few days of her visit. Her boy, born seven months subsequently, had a hare-lip and cleft palate. The mother stated that the deficiency in the lip and palate corresponded precisely with the location of the fracture in the plate.

Dr. Greenley[1] relates five cases in which infants at birth presented marks or arrested development corresponding in appearance with objects which produced strong mental impressions with the mothers.

Dr. W. A. Hammond of New York, in a paper upon the "Influence of the Maternal Mind," etc.[2] says: "The chances of these instances and others which I have mentioned being due to coincidence are infinitesimally small, and, though I am careful not to reason upon the principle of *post hoc, ergo propter hoc*, I cannot, nor do I think any other person can, no matter how logical may be his mind, reason fairly against the connection of cause and effect in such cases. The correctness of the facts can only be questioned; if these be accepted, the probabilities are thousands of millions to one that the relation between the phenomena is direct." Prof. Dalton also says:[3] "There is now little room for doubt that various deformities and deficiencies of the fœtus, conformably to the popular belief, do really originate in certain cases from nervous impressions, such as disgust, fear, or anger, experienced by the mother." The observations on which this belief is based relate both to man and the lower animals. A very strong argument in its support is, as Prof. Hammond remarks, the popular opinion, which dates back to the time of Jacob (Gen. xxx.). An almost universal sentiment, running through centuries, is rarely wholly fallacious. It has some truth for its foundation, especially when, as in this instance, the subject is one of observation.

If maternal emotions affect the development of the exterior of the fœtus, as observations show and physiologists admit, the presumption is strong that they may affect also the proper development and adjustment of the parts of the brain, an organ so complex and delicate, and may therefore give rise to idiocy. Dr. Seguin[4] thus remarks on this point: "Impressions will sometimes reach the fœtus in its recess, cut off its legs or arms, or inflict large flesh wounds before birth; . . . . from which we surmise that idiocy holds unknown though certain relations to maternal impressions as modifications to placental nutrition."

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[1] *Am. Prac. and News*, Oct. 29, 1887.

[2] *Quarterly Journ. of Psychological Med.*

[3] *Human Physiology.*

[4] *Idiocy and its Treatment, etc.*, N. Y,. 1866.

It is an interesting fact that abnormalities of structure, occurring from whatever cause, are likely to be propagated to descendants. Dr. Carpenter and others relate instances among the lower animals, and similar instances of transmission have now and then been observed in the human race. Thus, in the issue of *Nature* for March 7, 1878, it is stated on the authority of M. Lenglen, a physician of Arras, that a certain M. Gamelon in the last century had two thumbs on each hand and two great toes on each foot; this peculiarity did not appear in the son, but it reappeared in the three succeeding generations, so that some of the great-great-grandchildren possessed it in as marked a degree as their ancestors.

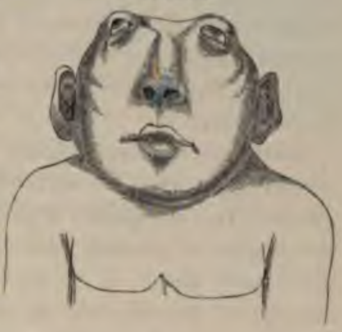
In view of such important facts the duty of the pregnant woman is rendered the more imperative to avoid the presence of disagreeable and unsightly objects, as well as all causes of excitement, and to remove as soon as possible vivid and unpleasant impressions by quiet diversion of the mind.

Malformations are numerous not only of internal organs, but of external and visible parts. We will only describe such as are of special interest to the accoucheur. Most malformations demand the attention of the surgeon rather than of the accoucheur.

ACRANIA.—In this malformation the bones and integuments forming the cranial arch are absent. In extreme cases the cranial arch, part of the neck, the brain, and the medulla oblongata are lacking. A vascular mass lies on the exposed base of the skull, often resembling the placenta in appearance. It consists of connective tissue in addition to the vessels. It is the representative of the cerebral meninges, and is continuous below with the spinal meninges. Its smooth surface is the analogue of the arachnoid. The sensation which is imparted to the finger of the accoucheur pressed upon it is very similar to that produced by a placenta. In some specimens small portions of cerebral matter are found among the vessels of this tumor, but they are so disconnected and isolated that they do not perform in any way the functions of a brain. Occasionally the vascular tumor is absent and the medulla—or, if this be absent, the upper extremity of the spine—is exposed

The absence of the brain and cranial arch gives a remarkable appearance. The frontal, parietal, and occipital bones are absent, except those portions which are near the base of the cranium. These portions are very thick and closely united, as if there were the usual amount of osseous substance, but instead of expanding into the arch it had collected in an irregular mass at the base of the cranium. The eyes are prominent, the neck thick and short, while the body and limbs are ordinarily well developed. The physiognomy has a frog-like appearance. Those portions of the cranial nerves which lie without the cranium are well developed, although the intracranial portions are absent. In this anomaly of acrania and anencephalus a twin is often present which in some manner has interfered with the normal development of the fœtus.

FIG. 134.



Symptoms.—If the medulla be absent, of course viability is impossible. If it be present, respiration may occur for a time, but is irregular. The monster may be made to cry, but the cry is a reflex phenomenon resembling a sob or hiccough. It may nurse, its digestive function is well performed, and regular urinary and fecal evacuations occur. There is a tendency in such monsters to convulsions. Blowing upon them and pressure upon the projecting medulla, if this be present, frequently produce this result.

Prognosis.—Fortunately, non-viability or speedy death is the result. If the medulla be present and respiration and circulation be established, nevertheless death usually results within two or three days, and with scarcely an exception within ten days. Convulsions sooner or later supervene, ending in fatal coma.

INCOMPLETE BRAIN.—Deficiencies occur in the formation of the brain, so that there are various grades of incompleteness between the normal and absent brain. Portions of the brain may be absent or rudimentary, while the remainder of the organ has its normal development. The deficiencies are usually in the cerebral hemispheres, while the base of the brain, which is important for the maintenance of life, is perfect. Both hemispheres may be absent, or one absent while the other is complete or small and rudimentary. Incompleteness of the brain may be manifested by the small size of the cranium and the retreating forehead, but occasionally the cranium has its normal shape and size, on account of an increase in the cerebro-spinal fluid proportionate to the deficiency in the cerebral development. Such a case was under observation in the Nursery and Child's Hospital in 1862. She took the breast and received food when placed in her mouth, but without apparent relish. She was supposed for a time to be blind, as she was apparently unconscious of objects around her. There was a total absence of intellectual manifestations. The size and shape of the head did not differ materially from the normal, but the frontal bone lay a little lower than the parietal. She died of entero-colitis at the age of ten months, and at the autopsy a sac containing about three-fourths of a pint of nearly transparent cerebro-spinal liquid occupied the site of the cerebral hemispheres. Rudimentary hemispheres were found constituting a part of the walls of the sac. The weight of the brain after being a few days in dilute alcohol was 6¼ ounces. In this case the fluid was nearly sufficient to compensate for the lack of brain-substance.

Symptoms.—Since in cases of imperfect brain in which life is preserved the arrest of development is usually in the cerebral hemispheres, the symptoms which indicate the deficiency relate chiefly to the degree of mental endowment. If the hemispheres are partially developed, there is a degree of intelligence proportionate to the amount of the cerebral substance present. If the arrest of development be on one side, there may be no appreciable lack of intelligence or mental activity, since one hemisphere may perform the functions of both.

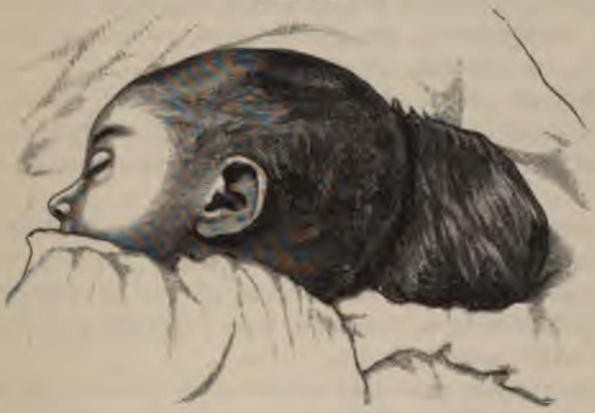
Prognosis.—This as regards life depends on the seat of the arrested development. If the cerebral hemispheres be deficient, the child may live and thrive, though idiotic; but if the arrest of development be at the base of the brain, which controls the functions of animal life and gives origin to nerves which are essential to the physical well-being, life is uncertain and probably will be short. It is evident that therapeutic measures cannot remedy a congenital deficiency in the brain, but the patient philanthropic teacher can impart some instruction to the idiotic, and occasionally improve in a measure their lamentable condition.

MENINGOCELE, ENCEPHALOCELE, HYDRENCEPHALOCELE.

This is the analogue of spina bifida. An opening exists at some point in the skull, through which the meninges, or meninges with brain-substance, protrude. The deficiency is congenital, and the tumor exists at birth or is noticed soon after. It is termed a meningocele if only meninges protrude; an encephalocele if it contain brain-substance in addition to the meninges; and a hydrencephalocele if, in addition to the brain-substance, the mass contain liquid in its interior.

The most frequent site of these tumors is the occiput, where the protrusion occurs from an opening in or at the edge of the occipital bone. The next most frequent location is the naso-frontal region. Rarely they occur upon the temporal, parietal, and basilar portions of the skull. Ordinarily, the opening in the occipital bone through which the protrusion takes place is at the median line, or near it, anterior or posterior to the occipital protuberance. The opening, if in the anterior part of the occipital bone, may extend to the fontanelle; if in the posterior part, it may extend to the foramen magnum. It may connect posteriorly through the foramen magnum with the cleft of a spina bifida. If the opening in the occipital bone be large, the tumor is also usually large. Prescott Hewitt cites a case in which it extended to the loins; but so large a mass consists mostly of liquid and is rare. An occipital encephalocele contains brain-substance from the cerebellum or posterior cerebral lobes or from both. If the tumor upon the occiput be a hydrencephalocele, the liquid is from the posterior cornu of a distended lateral ventricle or from a distended and dropsical fourth ventricle, and it occupies the interior of the tumor, the brain-substance surrounding it.

FIG. 135.



If the tumor be in the frontal region, the protrusion usually occurs between the cribriform plate of the ethmoid bone and the frontal bone, and it appears externally between the nasal and the frontal bones. Exceptionally, the point of protrusion is between the lateral halves of the frontal bone. The anterior lobe or lobes of the cerebrum protrude in an encephalocele in this location; if the tumor be a hydrencephalocele, the liquid is derived from the anterior cornua of the lateral ventricles. As a rule the frontal are smaller than the occipital tumors, and the skin covering them is more frequently red and vascular, so as to present the appearance of vascular tumors.

Exceptionally, the protrusion occurs from a fontanelle, or from the line of one of the sutures, so that it is seated upon the side of the skull. Cases are also on record in which the opening existed between the ethmoid and sphenoid bones, through the sphenoid, or between the sphenoid and its greater wing. Tumors in this location appear in the pharynx or mouth, or enter an orbit displacing the eye, or protrude through the spheno-maxillary fissure. The tumor, having this site, is usually an encephalocele or hydrencephalocele, the meningocele being rare. Its walls consist of skin, dura mater, and arachnoid, with intervening connective tissue. If the protrusion be at the base of the brain, of course the external covering of skin is lacking. In other locations the skin constitutes the external coat, and it may be tense and scantily covered with hair, or red and vascular. The interior of the sac is lined by the arachnoid and dura mater. These tumors, whatever the exact character of their interior, can be more or less reduced by compression, with a return of a part of their contents into the cranial cavity; but such compression usually produces cerebral symptoms, as stupor or fretfulness, vomiting, and strabismus. The following characteristics of the three forms of these tumors aid in their differential diagnosis:

Meningocele.—Small at first, and remaining either small or of moderate size, fluctuation distinct, pedunculated, translucent, no pulsation, tense on forced expiration, reducible.

Encephalocele.—Small, base wide, no fluctuation, opaque, or sometimes translucent at the apex, distinct pulsation, enlargement by forced expiration, partly reducible, cerebral symptoms occurring from compression.

Hydrencephalocele.—Tumor usually large, often pendulous, and its surface lobulated, pedunculated, fluctuating; portions translucent; pulsation absent or rare. It is seldom affected by pressure, and the patient is likely to be microcephalic from the escape of brain-substance external to the cranium.

These protrusions have been mistaken for various cysts, as cephalæmatoma, serous and sebaceous cysts, abscesses, vascular growths, and polypi. The fact that such errors in diagnosis have been made by various surgeons shows the importance of a thorough and careful examination before operative measures are employed.

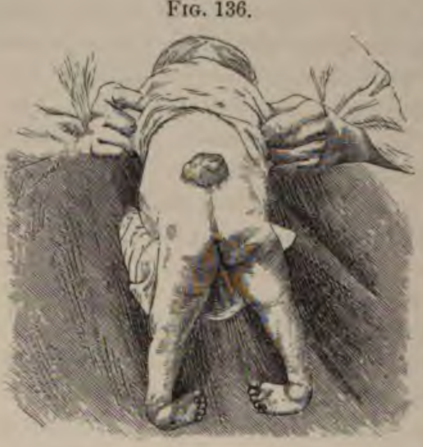
Most patients with this deformity die in a few weeks or months. The prognosis depends on the size of the aperture and the amount of protrusion. It is most unfavorable in hydrencephalocele, which is usually attended by deficiency of brain within the cranium, sometimes to such an extent that the patient is microcephalic and early death unavoidable. The hydrencephalic tumor is very liable to grow, and, after a time, rupture, causing immediate death in convulsions or collapse. In meningocele, if the aperture be small, the tumor may remain small, become isolated from the cranial cavity, and the patient may live for years. But of the three forms of the tumor, encephalocele is regarded as the most favorable, since it is usually small, and patients with it not infrequently live many years. The prognosis in these tumors is very similar to that in spina bifida, which varies according to size of the aperture and the amount and character of the protrusion.

Treatment.—Those who have had experience with these tumors concur for the most part in the opinion that surgical interference should not be resorted to unless rupture be imminent. The mass should be protected from abrasion, and that degree of pressure should be employed which can be tolerated without producing cerebral symptoms. It is proper to draw off the liquid of a meningocele if it be distended and likely to rupture, and the tapping may be repeated, with exceptionally the result of a cure or of rendering the tumor stationary. Mr. Holmes has injected the tumor with two drachms of a mixture consisting of one part of tincture of iodine and two of water, allowing it to remain; and Mr. Annandale has ligatured the mass in one instance, and affected a cure. In encephalocele and hydrencephalocele support and moderate pressure should be employed, and in the latter some of the liquid should be removed by a small trocar if rupture be threatening.

SPINA BIFIDA.

This is one of the most common of the malformations. In its severe form it is from its nature incurable, admitting only of palliative treatment, while in its milder forms it may be cured or so relieved that it does not endanger life. The term spina bifida is applied to a hernia of the spinal meninges, which produces a rounded tumor, situated posteriorly over the spine in the median line. It is due to the congenital absence or incompleteness of one or more of the arches of the vertebra. In exceptional instances the arch is said to be complete at birth; but the lateral portions separate and are pressed outward during the first weeks of life. The tumor contains cerebro-spinal fluid, and unless it be small, and its walls unusually thick, fluctuation may be detected in it. When the child cries the tumor enlarges, and it is reduced by compression, the fluid re-entering the spinal canal. If the tumor be large, its complete subsidence by pressure often produces dangerous cerebral symptoms. Spina bifida is the counterpart of hydrocephalus, and the two often coexist. If we compress the hydrocephalic head the spinal tumor enlarges, and *vice versâ*. Club-foot is another not infrequent complication. In the case which is represented in the accompanying woodcut (Fig. 136), hydrocephalus, spina bifida, and club-foot coexisted. The child was brought to the children's class in the Outdoor Department at Bellevue, and after a few visits I lost sight of it. It probably died soon after, since the tumor, over which the cuticle was wanting, presented a deep red appearance as if inflamed, so that ulceration and escape of the fluid seemed near at hand. There is ordinarily but one spina bifida, the common seat of which is the lumbar region, but occasionally two or more are present. If the aperture through which the tumor protrudes be small, it is usually pedunculated, but if large it is sessile. In some patients it is covered by skin, which may be normal or somewhat indurated; in others the skin is absent over the entire tumor or its most prominent part, and the dura mater or the connective tissue lying directly over the dura mater is exposed, and is liable to inflammation from friction. If the walls of the tumor be thin, the liquid may transude in drops, and they are liable to give way by ulceration or rupture. Sudden escape of the liquid and collapse of the spina bifida involve great danger, for convulsions, coma, and death are the common result.

FIG. 136.



The relation of the spinal cord or nerves, or of the cauda equina, to the tumor is a matter of great importance. In many patients the adjacent portion of the cord or cauda equina is deflected through the aperture, and lies against the interior of the sac. Spinal nerves also not infrequently lie within the sac, some returning into the spinal canal, and others passing through the walls of the sac to their points of distribution. Those which are deflected into the tumor and return into the canal obviously lie lowest. In the most favorable cases, to wit, those with a small aperture or small tumor, or a narrow and long peduncle, neither the cord, cauda equina, nor nerves lie within the sac. It is important to the practitioner to bear in mind that in all probability, unless under the favorable anatomical circumstances stated above, the sac contains nervous elements. In rare instances the liquid, instead of lying externally to the cord, lies within its central canal. The substance of the cord then becomes distended, and it encloses the liquid like a delicate sac, just as the hemispheres of the brain are unfolded and expanded in the common form of congenital hydrocephalus. As might be expected from the anatomical characters of the more serious forms of spina bifida, paralysis, more or less complete, of the vesical and rectal muscular fibres, and paraplegia sometimes occur, in which event the fatal issue is probably not far distant.

Diagnosis.—This is easy in ordinary cases. The congenital nature of the tumor and the bony edge of the aperture, appreciable to the touch, suffice in ordinary cases to establish the diagnosis. The diminution of the tumor by pressure, and its enlargement when the child cries, are important diagnostic signs. There are various lumbo-sacral tumors located in the median line from which it is important that spina bifida should be diagnosticated. Sometimes a cyst occurs in this situation which was originally a spina bifida, but obliteration of the canal in the pedicle occurred, just as the canal connecting a hydrocele with the abdominal cavity closes. Solid congenital tumors sometimes also grow in the same situation, among which, as most common, may be mentioned fatty tumors and tumors containing fœtal remains. The most common seat of tumors which enclose fœtal remains is at the point where spina bifida ordinarily occurs. Physicians have erred in mistaking these tumors, as well as those which consist of fat, for spina bifida; but a mistake in diagnosis can only occur through haste or carelessness of examination.

Prognosis.—This is in most instances unfavorable. Ordinarily the tumor increases slowly, and finally the sac gives way by ulceration or rupture; the liquid escapes, and death occurs in convulsions and coma; or, if the escape of the liquid be prevented by pressure and the aperture closes, a second rupture is probable, with a fatal result. In other cases the tumor may not rupture, but the cord is softened or it is injured by being bent, so that paraplegia results, and death after a time occurs in a state of emaciation. Rarely the tumor may shrivel by absorption of the liquid, and the disease is cured, or so nearly cured that it gives no inconvenience and the patient lives for years. In other rare instances the tumor may remain without any material change and without giving rise to symptoms. The spina bifida being small and covered with skin, and the aperture leading from it into the spinal canal being also small, the patient lives through the natural period of life with little inconvenience.

Treatment.—It is evident, from what has been stated, that no fixed rule can be laid down for the treatment of the spina bifida. In the most favorable cases, in which no symptoms occur and there is no indication that the tumor will undergo any unfavorable change, surgical treatment is not required, except the application of a soft pad to support the tumor, so as to prevent its injury by friction. Indications which justify active surgical interference are growth of tumor, absence of skin from it, with tension of the parietes, so that an early rupture is inevitable, and the occurrence of dangerous nervous symptoms, as convulsions or paraplegia.

From the nature of spina bifida it is evident that operations upon it must be conducted with caution. The usual presence of the spinal cord in the pedicle and in the sac forbids ligation and excision, and renders hazardous attempts to obliterate the sac by producing inflammation within it. A safe mode of treatment, but not the most efficient, is to puncture the sac and withdraw a portion of the liquid by a grooved needle or hypodermic syringe. A soft pad should then be applied to produce gentle compression. If no unfavorable symptoms occur, the puncture may be repeated after a day or two. This operation has been employed with a satisfactory result by Sir Astley Cooper among others; but, simple as it is, it is not devoid of danger, for the removal of the liquid, if carried beyond a certain point, may produce dangerous nervous symptoms, especially convulsions. In performing the operation the puncture should never be made in the median line, on account of the danger of wounding the cord, which lies against the median portion of the sac. The veins, also, should be avoided.

Another mode of treatment is by iodine injections. They are preferable to other methods if the neck be long and pedunculated, so as to be easily compressed. If the tumor be sessile, and the aperture into the spinal canal be free, these injections involve great danger, and are not to be recommended; for more or less of the solution will inevitably enter the spinal canal, and give rise to spinal meningitis. Iodine injections have been employed with success by Professor Brainard of Chicago, who states that he "perfectly and permantly cured" three of seven cases; and by Velpeau, of Paris, by whose method five in ten operations were successful, and by many others. Professor Brainard withdrew some of the liquid contents, and then injected half an ounce of water containing 2½ grains of iodine and 7½ grains of iodide of potassium. In a few seconds this was allowed to flow out, and the sac was then washed out with tepid water. Then a portion of the cerebro-spinal fluid, which had been kept warm, was returned into the sac. When he had withdrawn six ounces of this fluid he returned two ounces. In employing the iodine or any other irritating injection, it is necessary to compress the pedicle, so that the liquid does not enter the spinal canal. Velpeau employed one part of iodine, one of iodide of potassium, and ten of distilled water.

During a debate in the Société de Chirurgie, M. Debont recommended the evacuation of only a little of the fluid, and the injection of two or three drops of the tincture of iodine diluted with an equal quantity of water. T. Smith,[1] by the injection of one drop of the tincture, produced an amount of inflammation which nearly obliterated the sac. Since statistics show so good a result of iodine injections, this mode of treatment seems preferable to any other for certain cases, and as one drop has produced general inflammation of the sac and nearly obliterated it, it seems safest and best to begin with so small a quantity.

If there be reason to believe, from the small size of the orifice and other anatomical characters, that neither the cord, cauda equina, nor any of the spinal nerves lie within the sac, it may be thought best to remove the tumor. It has, indeed, been proposed to open the tumor, immersed under warm water, sufficiently to observe the relation of the nervous elements, and to press them back gently into the canal if they lie within the sac. If it be decided to remove the spina bifida, a clamp or elastic band is placed around the pedicle so snugly as to cause firm adhesion of the walls of the pedicle, and excite sufficient inflammation in them to produce agglutination, but without causing strangulation or suppuration.

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[1] *Holmes's Surg. Dis. of Children.*

After a time, perhaps two or three days, when it is evident that agglutination has occurred from the fact that the liquid cannot be returned within the spinal canal by compressing the sac, the tumor may be removed by the knife or écraseur. Statistics do not show so favorable a result of this operation as of the iodine treatment, and the reason is obvious, for it is only in exceptional cases that the tumor can be removed without injury to the nervous tissue, and incision of a portion of the cord or of important nerves either produces death or a condition to which death would be a relief.

Spina bifida has also been treated by opening the sac on its side, pressing back the spinal cord or its nerves into the spinal canal, uniting the edges of the wound, and then applying pressure to prevent protrusion, but the result has not been favorable. Treatment by simple puncture, followed by compression, and if it fail, as it probably will, the cautious use of iodione injections, is the preferable mode of treating ordinary cases of spina bifida which require surgical interference.

Congenital Abnormalities in the Circulatory System.

Rarely the position of the heart is abnormal, and the most common malposition is its location on the right side of the chest (dextro-cardia). This occurs with or without misplacement of other organs. In cases of dextro-cardia the liver usually, says Niemeyer, occupies the left hypochondrium, and the spleen the right. In this misplacement of the heart the aorta ordinarily crosses the right bronchus and passes along the right side of the vertebræ, but occasionally it crosses the spine and lies in its usual position on the left side of the vertebræ. The heart in this malposition is sometimes imperfect and sometimes well-formed. In mesocardia the heart is situated nearer the median line than usual, corresponding in this respect with the position which it occupies in the first months of fœtal life. A rare malposition is the location of the heart outside of the thoracic cavity (ectocardia extra-thoracica)—a condition accompanied by, and perhaps due to, deficiency in the sternum or sternum and ribs. In other instances equally rare a part of the diaphragm has been deficient, and the heart has lain in the abdomen; and in other instances still it has been located at the base of the neck. Breschet and others have cited examples of these various forms of ectopia cordis.

Symptoms—Prognosis.—If the heart be well formed and complete, its abnormal position within the thorax may not give rise to symptoms, and is not incompatible with prolonged life. If it be located without the thoracic cavity or be within the cavity and be defective, early death is probable.

PERICARDIUM.—An incomplete pericardium was described by Dr. Baillie in 1878, and since by other observers, among whom Peacock may be mentioned. The pericardium, instead of being normally developed, is represented by a fold or pocket lying over the right side or superior part of the heart. Individuals with this defect may live to middle age or even old age.

MALFORMATIONS OF THE HEART.—Malformation of the heart occurs—1st, from arrested development early in fœtal life, so that the organ remains rudimentary; 2d, from arrested development at a more advanced stage, when the cavities, septa, and vessels, though incomplete, are partially formed; 3d, from malposition of the parts of the heart or of the vessels in immediate relation with the heart. The cause of malformation in the heart and the vessels pertaining to it is obscure. It is supposed sometimes to be a myocarditis or endocarditis, which causes the arrest of growth or abnormal development.

Perhaps strong mental excitement sometimes has a causal relation, whatever may be its modus operandi, just as it causes external malformations. In a case related by Dr. Peacock[1] the mother stated that when pregnant she was greatly frightened by the appearance of a man who was dying of asthma. In another instance the only assignable cause was fright of the mother at seeing a child killed, and she did not recover from the shock;[2] in another case the mother was greatly alarmed at the fifth month of gestation,[3] and in the fourth instance the mother four or five months before her confinement was greatly frightened by her husband, who was insane, standing over her two hours with a loaded pistol.[4] But these are exceptional instances. In a large majority of cases of malformation of the heart inquiry fails to elicit any unusual mental excitement of the mothers during their gestation.

Occasionally the malformation appears to be due to some vice or taint in the system of one or both parents. Thus in a case quoted in the *Gazette médicale* for Dec. 28, 1850, the mother, who had rachitis in early life, lost five children soon after their birth, all of whom had lividity as the most prominent symptom. Persistent lividity in the newly-born indicates, almost without exception, malformation at the centre of circulation. In the history of a case which was communicated to Cooper by Farre, "vices of conformation of the heart appeared to have been inherent in the family. Of 12 infants only 4 survived," the death of the 8 being apparently from cardiac malformation. A patient treated by Mr. Leonard was the sixth who had died at about the same age with symptoms of cyanosis. Ordinarily, however, infants who have cardiac malformations, as indicated by the cyanotic hue, belong to healthy families; neither parents, brothers, nor sisters exhibit any taint of system which could sustain a causal relation to any form of malformation.

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[1] *Malformations of the Heart*, p. 57.

[2] *Ibid.*, p. 37.

[3] *Ibid.*, p. 41.

[4] *Ibid.*, p. 43.

The opinion is expressed by Gintrac that the number affected with cardiac malformation, as indicated by cyanosis, to the entire population varies in different countries. It is probable that its occurrence is not greatly, if at all, affected by the nationality, but it is certainly dependent to a considerable extent on the condition of society. It appears from statistics to be less frequent in a community in comfortable circumstances and engaged in quiet and wholesome occupations, than in one whose occupations produce undue mental excitement and worriment and irregularities in the mode of life. Pure air and out-door exercise, plain, nutritious diet, freedom from cares and anxieties—in fine, causes which promote the physical well-being—diminish the liability to a malformed and cyanotic offspring; and on the other hand, impure air, improper and insufficient diet, grief, etc. increase the percentage of cardiac malformations and cyanosis. Hence the blue disease is rare in the rural districts and comparatively frequent in the cities, especially in a large city like New York, which contains a numerous indigent and careworn population, living from year to year in the midst of agencies which operate stealthily but certainly to enervate the system and undermine the health.

These remarks are abundantly substantiated by statistics. In New York City, during the period of six years, 1 death resulted from cyanosis to 436 deaths from all causes, and in Brooklyn the proportion estimated for two years was about the same. On the other hand, in the State of Kentucky, which contains few large cities, there was, during a period of five years, 1 death from malformation of the heart to 2469 from all causes. In the State of South Carolina, for three years, 1 death resulted from cyanosis to 5018 from all causes. In the State of Massachusetts, for two years, there was 1 death from cyanosis to 1136 from all causes, and two-thirds of the cyanotic cases occurred in the counties of Suffolk, Essex, and Worcester, which contain large cities. In London 1 death occurred from cyanosis to 755 from all causes during a period of three years. On the other hand, in England, including the city of London, there was, for the ten years ending with 1857, 1 death from cyanosis to 1589 from all causes; and in the rural districts of Monmouth and Wales, only 1 death occurred from cyanosis to 5578 deaths from all causes during a period of two years.

Malformations of the heart derive their seriousness and importance from the fact that the heart is the central organ of circulation, so that when from malformation it is inadequate to perform fully its function, not only is the nutrition seriously interfered with, but the flow of blood through the lungs is insufficient. The blood is not properly oxygenated or depurated, and it is overcharged with carbonic acid, which imparts to it the deeply venous or livid color. Cyanosis, therefore, as indicative of an imperfect heart, a persistent defect in the circulation, and a permanently abnormal state of the blood, is an important disease.

CYANOSIS.—Cyanosis should be placed in the same category with other profound blood dyscrasias. As stated above, when occurring in young infants, the cause is at the centre of circulation, and is a malformation with very few exceptions. The diagnosis can be made with certainty if there have been no symptoms indicating an antecedent disease. In rare instances in infants above the age of five or six months lividity of the surface occurs from *disease* in the lungs, such as extensive emphysema, a pleuritic exudation compressing both lungs, caries of the vertebræ, with consequent depression of the ribs so as to prevent proper inflation of the lungs. But such causes do not exist or are very rare in the neonati.

The blue disease, being so manifest, attracted attention at an early age. It appears from the remarks of Boerhaave that the common people believed that the cyanotic were possessed by evil spirits.[1] It was evidently impossible to understand its cause and nature prior to the discovery of Harvey in the seventeenth century, and most of the exact or scientific knowledge possessed by the profession in reference to the etiology and nature of cyanosis has been achieved since the present century commenced. Boerhaave and Vieussens had observed cases and propounded theories in reference to it, but the knowledge of physicians concerning it remained vague and indefinite. No better idea can be given of the prevailing ignorance in reference to cyanosis, even after the present century commenced, than by quoting from a case related by Ribes in 1814.[2] The patient had some time previously received an injury of the finger. "Many physicians of Amsterdam," says he, "were at different times consulted on the subject of this affection, no one of whom understood its true cause, its essential character. One considered it as partaking of the nature of epilepsy, and caused by the irritation in the nervous system which the wound in the finger had produced. Others attributed it to the presence of intestinal worms. Some physicians pronounced it an injury to the liver or spleen. Many held it to be a scorbutic affection. One only believed it to be the result of an unknown organic disease." In the present century numerous carefully-observed cases of cyanosis published in the medical journals, and the writings of Seiler, Louis, Bouillaud, Farre, Chevers, Peacock, Marston, Stillé, and others, have contributed to a better understanding of the nature and anatomical characters of cyanosis.

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[1] *Diseases of the Humors.*

[2] *Bull. de la Fac. de Méd.*, 1815.

Sex.—Whatever may be the explanation, the following statistics show an excess of male infants affected with cyanosis:

TABLE 1.

180 cases collated by Aberle	two-thirds males.		
44 " " " Gintrac	28 males,	16	females.
41 " " " Stillé	31 "	10	"
134 " " " J. Lewis Smith	78 "	56	"

TABLE 2.

Deaths from Cyanosis.

	Males.	Females.
In London, England, in two years	418	273
In New York City, in five years	117	90

Time of Commencement.—It is an interesting and somewhat remarkable fact that cyanosis, though dependent on a malformation, does not always commence at birth, or at least does not exist in degree sufficient to produce the cyanotic hue till some time has elapsed after birth. In 138 of the cases of cyanosis which I have collected the time at which lividity was first observed is stated as follows: In 97 it was within the first week, and generally within a few hours of birth. In the remaining 41 cases it commenced as follows:

In 3 at 2 weeks.
" 1 " 3 "
" 2 " 1 month.
" 7 from 1 to 2 months.
" 5 " 2 " 6 "
" 5 " 6 " 12 "
" 3 " 1 year to 2 years.
In 6 from 2 years to 5 years.
" 1 " 5 " " 10 "
" 6 " 10 " " 20 "
" 1 " 20 " " 40 "
" 1 over 40 years.
41, total.

In these 41 cases, in which blueness did not occur till after the age of one week, if the patient were less than two years old when it commenced there was frequently no obvious exciting cause, but above this age, with three exceptions, such a cause is known to have been present. It is interesting to observe how trivial the exciting cause frequently is, and equally interesting to note how long patients have enjoyed good health, not having the least lividity, although the anatomical vice to which the final development of cyanosis was due had existed from birth.

Dr. Theophilus Thompson relates[1] the history of a lady, thirty-eight years old, who was well till an attack of Asiatic cholera, after which her health was permanently impaired. Two years before her death she passed through a course of fever, and from this time was cyanotic. In the *Philadelphia Medical Examiner*, June, 1850, Dr. Waters relates a case in which cyanosis began at the age of six years in an attack of measles. In a case published by Mr. Napper in the *London Medical Gazette*, 1841, the child fell at the age of six months, and from this time had cyanosis. A female whose history is given by Prof. Tommasini of Bologna, and quoted by Bouillaud, became cyanotic at the age of twenty-five in consequence of difficult parturition. In the *London Lancet*, 1842, Mr. Stedman relates a case, in which cyanosis began at the age of ten weeks in an attack of convulsions. In the *American Journal of Medical Sciences*, in 1847, Dr. John P. Harrison published the history of a baker, twenty years old, in whom cyanosis began five years previously after great effort in carrying wood. Louis and Bouillaud quote from M. Caillot the case of a child who became cyanotic at the age of two months in an attack of whooping cough. Louis also narrates a case in which whooping cough had the same effect at the age of twelve years. Ribes treated a child in whom the blue disease began at the age of three years from a severe contusion of the fingers. In a case related by Marx it commenced at the age of ten months from a blow on the back inflicted by the mother. In the *Medical Times and Gazette*, for 1855, Mr. Speer gives the history of a female who at the age of thirteen years was put in a place requiring considerable exertion, and from this time was cyanotic. A patient whose case was related by Cherrier fell into a deep ditch in the winter season, and immediately after had a low fever, from which the blue disease commenced. In a case published by Taconus the exciting cause was believed to be fright in consequence of a fall from a great height, and in another, related by Bouillaud, it was a blow received on the epigastrium after the patient had passed the age of fifty years. Similar cases are related by Mayo and Peacock.

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[1] *Medico-Chir. Trans.*, vol. xxv.

It will be seen that the exciting cause of cyanosis is usually such as produces a profound impression on the system and affects the action of the heart. Precisely in what way it operates to develop the disease has not been satisfactorily explained. Mr. Mayo conjectures that in the case related by him there was previously some compensation which ceased or became inadequate in consequence of some change produced in the economy. Although cyanosis may not appear for months or even years, there is rarely improvement when it is once established. Appearances of amendment are deceptive. The disease when not stationary is progressive, and this explains the fact that few survive the middle period of life.

Symptoms.—The symptoms in cyanosis vary in intensity in different patients, and in the same patient at different times, being milder if he be quiet and the mind calm, more severe if active or if the mind be agitated. In mild cases, in a state of rest, they nearly or quite disappear, so that a stranger would not suspect that there was any serious ailment. They are aggravated by any cause which accelerates the action of the heart. In some patients cyanosis is increased by the most trivial disturbing influences, among which may be mentioned nursing, dentition, crying, coughing, and slight emotions of joy, sorrow, or anger. In more than one case it has been perceptibly increased by the stimulus of digestion, the color being deeper after a full meal than before.

The cyanotic hue varies in different individuals from duskiness to a deep purple, almost black, color. It is usually most marked in the visage, especially the palpebræ, cheeks, nose, and lips, in the ears, fingers, and toes, and upon the mucous surfaces. It is sometimes, without any assignable cause, confined to a portion of the body. In a case related by Mr. Steel in the London *Lancet*, 1838, the upper part of the body was livid and œdematous, and the lower part pallid and shrunken, and yet the malformation was of the kind which is commonly present in cyanosis. In the *London Medical Times*, March 8, 1845, copied from the *Gazette médicale*, is the history of a child, six years old, in whom the color was deeper on the right than left side. There had been, however, hemiplegia of this side in infancy, but this had entirely passed off. On the other hand, in a case of rare malformation communicated by Cooper to Farre, in which the upper part of the system was supplied chiefly by arterial and the lower by venous blood, the discoloration was general. In exceptional instances livid maculæ, like those of purpura, have been observed upon the skin.

Those affected with cyanosis have generally at birth been well formed and of the usual size, and in most cases for a considerable period after birth the appetite is good, bowels regular, and the system well nourished. But when cyanosis becomes so severe, as it does sooner or later, that its symptoms are rarely absent, digestion is imperfectly performed and the body becomes either emaciated or stunted and puny. It may be stated, as a rule, that nutrition is in inverse proportion to the gravity of cyanosis. In 33 out of 41 cases in which the condition of the system as regards nutrition was recorded either a short time previously to death or at the autopsy, the body was either considerably emaciated or else diminutive, and those who were well nourished were usually such as had died early or of some intercurrent disease.

In this connection may be mentioned two abnormalities which have been observed in the cyanotic. The chest is often flattened laterally with a projecting sternum, so as to present an appearance generally described in the records as "pigeon-breasted." Sometimes the most prominent part is directly over the heart, and in one or two cases the sternum was observed to be deflected toward the left. In the majority of the records, however, no mention is made of the external appearance of the chest.

The other abnormality is frequently observed in chronic diseases of the heart and lungs, in which there is sluggish circulation and consequent altered nutrition in the fingers and toes. In 28 of the cases collated by myself it is stated that the tips of the fingers or toes, or both, were bulbous. This hypertrophy, if slight, is likely to be overlooked, and that it was observed and recorded in so many cases renders it probable that it was present in a much larger number. In one case the anatomical character of this enlargement was examined, and was found to consist chiefly of hypertrophied connective tissue.

The nails are often incurvated over the deformity. At a meeting of the London Pathological Society in 1859, Mr. Ogle narrated the history of a laborer, fifty years old, who had swelling, numbness, and lividity of the left arm from pressure of an aneurism, and the fingers on this side were clubbed as in cyanosis. A patient whose history is related in the *Glasgow Medical Journal*, and who was believed to be cyanotic in consequence of a highly emphysematous state of the lungs, had a similar development of the tips of both fingers and toes.

An interesting feature in cyanosis is the low grade of animal heat. The temperature of the body is in all cases below that of health. This is especially noticeable in the extremities. There has not been a sufficient number of accurate thermometric observations to determine whether the internal heat is usually reduced. The following only have been recorded: Mr. Fletcher relates the history of a young man in the *Medico-Chir. Trans.*, vol. xxv., in whom the thermometer placed in the mouth did not stand above 80° Fahr. Hodgson reports the case of a man, twenty-five years old, in whom the thermometer placed under the tongue rose to 100°. Perhaps a more thorough examination might have disclosed an intercurrent malady to cause the fever. In an examination recorded by Nasse the instrument placed in the mouth fell little if at all below the healthy standard; applied to external parts, it stood at about 21° Reau.= 79.2° Fahr.

The lack of heat is the source of great discomfort to a cyanotic patient. In mild weather he requires a fire to keep him warm or an amount of clothing which to others would be uncomfortable, and in cold weather slight exposure strikes him with a chill. Nor can he increase his heat by active exercise, since his infirmity disqualifies him for this.

Although the temperature of the surface is so low, the occurrence of perspiration, sometimes profuse, is mentioned in several of the records.

In severe cases of cyanosis the generative system is imperfectly developed. In the female menstruation is scanty or delayed, and in the male signs of puberty are feebly manifest. If the disease be so mild that the symptoms are absent when the patient is in a state of repose, these organs attain nearly or quite their normal development. The catamenia have appeared as early as the age of sixteen years, and a cyanotic patient treated by Cherrier had two children, but they both died of scrofulous affections.

The action of the heart is necessarily much involved. In mild forms of the disease, if the patient be quiet, this organ may beat with considerable slowness and regularity, but in all cases exercise or excitement which in a state of health would scarcely have any appreciable effect on the pulse embarrasses its movements and produces palpitation. In severe cases palpitation is rarely absent, and the pulse is frequent, feeble, and often intermittent. In a large proportion of patients bruits are produced by the irregular circulation through the heart.

The respiration corresponds with the action of the heart. It is accelerated in proportion to the frequency of the pulse. The suffering in this disease is largely due to paroxysms of palpitation and dyspnœa. These occur sometimes without any apparent exciting cause, and when the patient is quiet, but they are commonly induced by those causes which we have already mentioned as aggravating the symptoms of cyanosis. They come on suddenly, and are attended by increase of lividity, distension of the jugulars, and sometimes of the cutaneous veins, and by a sensation of present suffocation. They last only a few minutes, and are succeeded by great depression of the vital powers. In infants, on account of greater nervous irritability and feeble power of endurance, these paroxysms often end in convulsions, which occasionally are fatal. A cough is sometimes present, but is usually slight.

Pain is not a common symptom. Some of the patients complain occasionally of headache, with or without vertigo, and occasionally also of pain in the chest, but it is uncertain to what extent or whether these symptoms are dependent on the cyanotic disease. The secretions do not appear to be affected, so far as has been ascertained. The same may be said of the intellectual and moral faculties. In a case related by Dr. Cheevers the child was even said to be precocious.[1] The mind is capable of steady application and acquisition, as in health, provided that the emotions are not unduly excited.

The cyanotic are liable to various forms of hemorrhage, but the records show that this liability is greater in youth and adult life than in infancy. In 2 cases blood was vomited, in 1 passed by stool, in 1 it escaped from the gums, in 2 from the mouth, in 8 from the nostrils, and in 16 it was expectorated. Pulmonary phthisis was, however, usually present in these last cases. In the *Western Journal of Medicine* for

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[1] *Lond. Med. Gaz.*, vol. xxxviii.

1829 an interesting case is related by Dr. William M. Voris of a girl nine years old in whom hemorrhage occurred under the scalp, producing great tumefaction and nearly closing the eyelids. An incision was made, from which a pint and a half of dark blood escaped, and it was estimated that more than half a gallon was lost during the ensuing two weeks, at the expiration of which time the incision closed. The patient recovered from the hemorrhage, but not from the cyanosis.

Toward the close of life more or less anasarca occasionally occurs, especially around the ankles, sometimes in the eyelids and face, and rarely to a certain extent over the whole body. In certain patients it coexists with effusion in the serous cavities.

It is evident that one who is affected with the severer form of cyanosis is disqualified for the duties of active life. The sports of childhood and the useful labors of mature years require an exertion for which he is physically unfit. He has not the ability even to engage in animated conversation, for he is overcome by emotions, whether of joy or sorrow. He lives almost an idle spectator of the world around him, prevented by his infirmity from engaging in its pursuits.

Intercurrent diseases, especially those of childhood, are badly tolerated, but whooping cough is the one which these patients are especially ill-fitted to endure. Still, they sometimes pass safely not only through whooping cough, but through some of the most dangerous febrile diseases. It is a question of interest, but about which little is known with certainty, whether these intercurrent maladies are influenced by the cyanotic or venous condition of the blood. The symptoms of these maladies are no doubt more alarming, mainly on account of the embarrassed action of the heart, and not on account of the state of the blood; still it is reasonable to suppose that malignant and asthenic diseases are rendered worse by the lack of oxygen and excess of carbonic acid in the circulating fluid.

Probably cyanosis does not furnish immunity from any other disease, although this statement has been made by a high authority. Rokitansky says: "All forms of cyanosis, or rather all the diseases of the heart, great vessels, and lungs, adapted to produce cyanosis in a greater or less degree, cannot coexist with tuberculosis. Cyanosis affords a complete protection against it, and in this circumstance may be found an explanation of the immunity from tuberculosis which many conditions of the system, apparently very different in their character, afford."[1] This opinion of the distinguished pathologist, notwithstanding his ample opportunities for observation and known accuracy as an observer, is not substantiated by statistics. So far from its being true, the low degree of vitality in cyanosis appears to favor the occurrence of tubercles. I have records of 26 cases of cyanosis in which tuberculosis was also present, in several of which the lungs contained cavities. This is about 13 per cent. of the whole number in my collection—a large proportion, since so many die in early infancy, at which period the tubercular disease seldom occurs. Cyanosis appears also to favor the development of cerebral diseases, especially congestion and coma, as will be seen presently.

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[1] *Handb. der Path. Anat.*, Bd. ii.

Prognosis.—This is unfavorable. Most cyanotic individuals die young. The age which they attain has been made the subject of statistical inquiry by Aberle. He states that in an aggregate of 159 cases, 57, or 35 per cent., died before the end of the first year; 108, or more than two-thirds, died before the age of eleven years; 30 between the ages of eleven and twenty-five years; and of the remaining 21, only 5 lived more than forty-five years.

The age at which death occurred is given in 186 of the cases collected by myself, as follows:

In 17 under the age of 1 week.
" 10 from 1 week to 1 month.
" 12 " 1 month to 3 months.
" 11 " 3 " to 6 "
" 17 " 6 " to 12 "
" 12 " 1 year to 2 years.
" 21 " 2 years to 5 "

In 21 from 5 years to 10 years.
" 41 " 10 " " 20 "
" 20 " 20 " " 40 "
" 4 over 40 "
186, total.

67, then, or more than one-third, died before the close of the first year; 121, or more than three-fifths, before the age of ten years; only 24 survived the age of twenty years, and four the age of forty years. Of course the duration of life depends on the nature and extent of the malformations. Some of these are such as render a speedy death inevitable.

Mode of Death.—The mode of death is reported in 95 cases as follows:

19 died in a paroxysm of dyspnœa.
10 " suddenly (the exact manner not stated).
14 " in convulsions (infants).
2 " of apoplexy.
7 " from hemorrhage.
6 " of phthisis (though, as we have seen, 20 others had this disease).
2 " of exhaustion, without hemorrhage.
10 " of coma.
2 " of abscesses in the brain.

One died of each of the following diseases: cerebral irritation, congestion of brain, effusion in the cranial cavity, acute hydrocephalus, paralysis from acute softening of the brain, dysentery, inflammation of heart, syncope, mucus in the air-passages, thoracic inflammation, choleraic diarrhœa, pneumonitis, bronchitis, scarlet fever, croup. 1 died in trying to walk, 1 after a spasmodic cough in pertussis, 1 after a long agony, 1 after an agony of ten or eleven hours; 1 is reported to have died gradually and 3 quietly.

The 10 who are stated to have died suddenly probably died in paroxysms of palpitation and dyspnœa, which are easily excited and of common occurrence in cyanosis. If so, this was the mode of death in 29 cases. Infants with few exceptions, so far as appears from the records, died in convulsions. 19 died of cerebral affections, exclusive of convulsions, and in 13 of these the cause of death was congestion, apoplexy, or coma. The hemorrhage of which 7 died was probably, in most instances, dependent on phthisis, and 6 are said to have died directly of phthisis. We, may then, regard paroxysms of palpitation and dyspnœa, convulsions, congestive affections of the brain, and phthisis as common modes or causes of death in cyanosis.

The malformations of the heart and great vessels which give rise to cyanosis are quite numerous. The following table exhibits their character and relative frequency:

		Cases.
1.	Pulmonary artery absent, rudimentary, impervious, or partially obstructed	97
2.	Right auriculo-ventricular orifice impervious or contracted	5
3.	Orifice of the pulmonary artery and the right auriculo-ventricular aperture impervious or contracted	6
4.	Right ventricle divided into two cavities by a supernumerary septum	11
5.	One auricle and one ventricle	12
6.	Two auricles and one ventricle	4
7.	A single auriculo-ventricular opening; interauricular and interventricular septa incomplete	1
8.	Mitral orifice closed or contracted	3
9.	Aorta absent, rudimentary, impervious or partially obstructed	3
10.	Aortic and the left auriculo-ventricular orifices impervious or contracted	1
11.	Aorta and pulmonary artery transposed	14
12.	The cavæ entering the left auricle	1
13.	Pulmonary veins opening into the right auricle or into the cavæ or azygos veins	2
14.	Aorta impervious or contracted above its point of union with the ductus arteriosus; pulmonary artery wholly or in part supplying blood to the descending aorta through the ductus arteriosus	2
	Total	162

From the above table it appears that in more than one half of the cases of cyanosis the congenital vice which gives rise to it is located in the pulmonary artery. It is located also, in general, in that part of the artery which is nearest the heart. Its character is different in different cases. Sometimes there is an arrested development of this vessel, and in its place we find simply a ligamentous cord extending from the heart as far as the ductus arteriosus, while beyond this point. the artery and its branches are pervious; rarely the entire artery is ligamentous, and of course impervious; in other cases this vessel is open through its whole extent, but the part nearest the heart is so small as to be properly considered rudimentary; in others still there is adhesion of the valves to each other as the chief congenital defect; and finally, in rare instances the obstruction in the pulmonary artery is due to an adventitious membrane which stretches across the vessel like a diaphragm. These last malformations—namely, adhesion of the valves and the formation of an adventitious membrane—are doubtless due to inflammation occurring in the artery before birth, and some attribute the arrested development and ligamentous state of the vessel to the same cause.

In most cases of cyanosis due to obstructive malformations the inter-auricular and interventricular septa are more or less deficient. This deficiency obviously results from the obstruction, for the septa are formed in the heart after fœtal circulation is established, and the blood, being prevented by the vicious formation from flowing in its proper channel, necessarily passes to the opposite side of the heart. More or less blood being forced from one auricle or one ventricle to the opposite cavity, it is evident that a permanent aperture must result in the septum. The aperture in the septum ventriculorum is ordinarily at its base; in the septum auriculorum it corresponds with the foramen ovale.

In most of the obstructive malformations one, and rarely two, abnormal cardiac murmurs have been observed. The single murmur accompanies the ventricular contraction. As it has been observed in cases of complete as well as incomplete obstruction, it seems to be due mainly to the flow of blood through a narrow or constricted pulmonary artery or the apertures in the septa.

Modes of Compensation.—In most cases of cyanosis the congenital defect is partially obviated by modes of compensation. In the most frequent malformation, that in which there is obstruction in the pulmonary artery and a considerable part if not all the blood flows directly from the right to the left side of the heart, the ductus arteriosus not only remains open, but is greatly enlarged, through which a current of blood enters the pulmonary artery from the aorta, and, passing to the lungs, is oxygenated. The bronchial arteries have also been found greatly enlarged, and it is believed that though they are the nutrient arteries of the lungs, the blood which they convey to these organs is decarbonized in its circuit through them. In a case published by Mr. Le Gros Clark in the *Medico-Chir. Trans.*, vol. xxx., the bronchial arteries were not only enlargeḋ, but a "branch from the internal mammary artery, which accompanied the phrenic nerve, was nearly equal in size to the parent trunk, and expended itself principally in the adjacent adherent lung. Branches of the intercostal arteries have also been found enlarged, and entering the lungs or connecting with vessels which enter the lungs. By such modes of compensation cyanosis is rendered milder and life is prolonged. To these we must attribute the fact that some have very considerable malformation, and yet do not become cyanotic.

Morbid Anatomy.—This, as regards the circulatory system, has been sufficiently dwelt upon. No chemical analysis, so far as I am aware, has yet been made of cyanotic blood. We know that it is dark, its coagulability feeble—that it contains an excess of carbonic acid, and is deficient in oxygen. From the nature of cyanosis it would be inferred that in many cases there is a degree of passive congestion in the cavities of the heart, and consequently in the capillaries of the systemic system, giving rise to more or less serous effusion. Statistics show that this is so. The quantity of pericardial fluid is in some patients increased. I have records relating to this fluid in 51 cases. Usually it was pure serum. In 17 the quantity was half an ounce or less, if we include in the number those in which the amount is expressed in such terms as "due quantity," "usual amount," and "small amount." In 24 cases the pericardial fluid (serum) exceeded half an ounce, usually estimated at from 1 to 6 ounces, but in 2 it exceeded the latter quantity. In 1 of the 24 this fluid was stained with blood. In 2 patients the records state that there was a small quantity of pure blood in the pericardium, and in 1 the two pericardial surfaces were agglutinated by inflammation.

In some of the autopsies serum was found in the pleural cavities, usually in connection with pericardial effusion, and in at least one instance this fluid was tinged with blood. Old adhesions between the costal and pulmonary pleura were observed in a few cases. The condition of the lungs was recorded with more or less minuteness in 110 cases. Mention has already been made of the large number affected with tubercular disease, which was either confined to the lungs or was chiefly exhibited in these organs. In 35 patients the records state that the lungs were of small size, either by compression or sometimes, apparently, from the continuance of the fœtal state over a greater or less portion of the organ. The compression was produced either by the distended pericardium or by effusion in the pleural cavities. In 35 cases the lungs presented a dark color. This hue in some specimens accompanied the unexpanded or fœtal state of the organ, but in others there was the normal inflation, and the dark color was due to engorgement or congestion. In other cases the lungs are stated to have been natural except the color. In 9 emphysema was present in a part of the lungs, in 2 pneumonitis; in 2 the color of the lungs was pale, in 1 a bright crimson; in 1 the lungs were larger than natural, in 1 the right lung was absent, and in 17 these organs were recorded healthy.

I have records of the state of the liver in 26 cases, in 16 of which it was enlarged, and in 4 of these it was congested. Congestion of the liver was present in 8 other cases in which no mention is made of its volume. The parenchyma of this organ had a natural appearance in 9 cases, but in some of these there was enlargement. From these statistics it is probable that the liver is commonly enlarged in cyanosis, and not infrequently congested. In a few cases the condition of the other abdominal viscera is mentioned—in some as healthy, in others as congested. Fifteen examinations of the brain were made, in 7 of which congestion is recorded, and in 3 abscesses in the cerebral substance, in 1 of which cases the lateral ventricle was also filled with pus; in 2 softening of a portion of the brain had occurred, in 3 the brain was firm or compact, in 3 the quantity of fluid in the cranial cavity exceeded the normal amount, and in 1 it was less than normal.

Theories Relating to the Etiology of Cyanosis.—Although in nearly all cyanotic patients there are direct communications between the two sides of the heart, it is shown by many observations that these communications or apertures are not sufficient in themselves to produce cyanosis. This opinion was expressed half a century ago by Louis, who published an excellent monograph on the subject of these communications, basing his remarks on an analysis of twenty cases. Since the publication of this paper, the belief has been pretty general in the profession—and observations continue to substantiate it—that although the apertures may be of considerable size, if the two sides of the heart, with their orifices and vessels, are in their normal state, so that they act symmetrically and without obstruction, the blood is sufficiently oxygenated and decarbonized, and cyanosis does not occur. In proof of the correctness of this opinion many cases might be cited of a pervious and some of a largely dilated foramen ovale without the cyanotic hue—cases which have been published in the journals since the appearance of Louis' monograph. Still, in cases of obstructive malformation, unless the obstruction be complete, cyanosis is more likely to occur in consequence of these apertures, for were they absent a larger amount of blood would be propelled through the narrow orifice and a larger amount consequently be oxygenated.

Allusion has already been made to the two theories which prevail in the profession: the one attributing the non-oxygenation of the blood and its highly venous character, so as to cause the cyanotic hue, to the intermingling of venous and arterial blood; the other to obstruction at the centre of circulation and consequent venous congestion. There are serious objections to the acceptance of either theory as an explanation for all cases. That admixture of the two kinds of blood is not essential to the production of cyanosis is apparent from the following facts: In one case in the *Fourth Malformation* there was no communication between the two sides of the heart, and the ductus arteriosus was closed, so that admixture was impossible. Again, in the *Eleventh Malformation*, or that in which the aorta and pulmonary artery are transposed, the blue disease evidently does not depend on the admixture of the two currents. On the other hand, in this curious state of the heart the more the admixture the less the cyanosis, since the only way in which the systemic current of blood can be arterialized is by passing to the opposite side of the heart. An argument against this doctrine may also be found in the fact that the modes of compensation are not such as in any way to diminish or obviate the admixture. It is admitted that in the more frequent malformations cyanosis is increased by the apertures, which allow the intermingling of the venous and arterial currents, but it is more reasonable to consider the intermingling and the cyanosis as the direct results of the malformation, neither having the precedence of the other, than to consider that they are related to each other as cause and effect or as proximate and remote results. Viewed in this light, the admixture must be considered simply a concomitant of the cyanosis.

The second theory, that of venous congestion, has numbered among its advocates many who have given special attention to the subject, as Morgagni, Louis, and Stillé, but it seems to have even less claim for acceptance than the theory of admixture. It has been seen that in nearly all cases of cyanosis the two sides of the heart communicate freely, so that if the current of blood meets with an obstruction, as it commonly does, it readily escapes to the opposite side, where the artery is large and gives it free passage. In this way congestion, if not prevented, is greatly diminished. Again, it will be seen that, although certain of the viscera are frequently found at the autopsy more or less congested, congestion is not uniformly present in the organs, as it would probably be were it the proximate cause in all cases of cyanosis.

Moreover, in some patients the malformation is not obstructive. The cavities and their orifices are of the normal size, and cyanosis is due entirely to malposition of the vessels. It cannot be said that in these cases there is venous congestion from arrest at the centre of circulation. If there be any congestion, it must be due to the fact that venous blood does not circulate as readily as the arterial in the capillaries. It is true that in the paroxysms of dyspnœa there is sometimes more or less congestion—the distension of the jugulars shows this—but it subsides with the paroxysms, and it probably is no more than usually occurs when respiration is greatly embarrassed.

In fine, attempts to express the immediate pathological state producing cyanosis in the terms of a general law have failed. However plausible the above theories may appear in regard to certain cases, there are others to which they are manifestly inapplicable. Those who advocate these theories seem to lose sight of the obvious fact that the chief want of the economy in cyanosis is decarbonization of the blood, and it is hardly supposable that there can be any correct theory of its causation which is not founded on this fact. With this physiological state in view, it does not seem difficult to express a theory in comprehensive terms which is applicable to all cases, such as the following: Cyanosis is due to malformations of the heart and the great vessels in immediate relation with the heart, which prevent the proper flow of blood to and from the lungs, so that the oxygenation and decarbonization of this fluid are inadequate. So comprehensive a statement includes not only cases of malformation and malposition of the heart and its vessels, but also those few cases in which the lungs are in fault. In most patients, as we have seen, the current of blood *toward* the lungs is obstructed, and the current of blood *from* the lungs in those comparatively rare cases in which the malformation is on the left side.

Treatment.—From the nature of cyanosis it is evident that the treatment should be more hygienic than medicinal. The patient should be warmly clad and kept in a warm room, and all agencies calculated to embarrass or disturb the functions of the body or excite the emotions, and thereby accelerate the heart's action, should be studiously avoided. The diet should be nutritious, but simple and easily digested.

Those who have attributed cyanosis wholly to apertures in the interauricular and interventricular septa, and the consequent flow of blood from the right to the left side of the heart, have considered it an important part of the treatment to keep the patient reclining on the right side, so as to diminish this flow by the effect of gravitation. The reader, however, must be convinced from the nature of the malformations that little benefit can accrue from following such advice. Still, patients are sometimes less cyanotic and more comfortable in one position than another. In a case reported by Mr. Howship[1] "the only easy and indeed comfortable position in which the child could remain was that usual in nursing. When erect the dusky color of the face and neck became a dark-blue." In a case related by Mr. Spackman[2] the patient was easiest on the hands and knees. Louis reports a case[3] in which the selected position was with the head elevated; Wm. Hunter a case[4] in which the patient avoided paroxysms by lying on the left side. Struthers and King each report a case in which the patients seemed most comfortable while lying on the right side;[5] while, on the other hand, Professor White of Buffalo[6] and Dr. James Carson[7] report cases in which position on the right side failed to produce any alleviation of symptoms. Other similar observations might be cited, but enough have been mentioned to show that no one position should be recommended for cyanotic patients. Some obtain most relief by lying on the back, others on the right side, others on the left; some when on the hands and knees, some when reclining on either side indifferently, while, finally, others suffer least when erect.

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[1] *Edin. Med. Journ.*, 1813.

[2] *Lond. Med. Gaz.*, 1833.

[3] *De la Commun. des Cav., etc.*

[4] *Med. Obs. and Enq.*, vol. vi.

[5] *Monthly Journ. of Med. Sci.*

[6] *Buf. Med. Journ.*, 1855.

[7] *Amer. Journ. of Med. Sci.*, 1857.

There was a time when the paroxysms were treated by venesection, but depletion has long since been abandoned. Physicians now rely on stimulants, antispasmodics, friction to the chest, and mustard pediluvia to relieve the urgent symptoms, although this treatment is but partially successful. It is probable that of all internal remedies digitalis is the most useful, from the fact that it is an efficient heart-tonic and more than any other medicine gives strength and equality to the heart-beats. In the cities where oxygen gas can be procured for daily inhalation the urgent symptoms may in some instances be partially relieved by the use of this agent.

CAPUT SUCCEDANEUM.—During the birth of the child extravasation of blood frequently occurs in the part of the scalp which presents. It results from the passive congestion which occurs in presenting parts, and is greatest in amount when the labor has been protracted and the labor-pains unusually severe. *Caput succedaneum* is the term employed to designate the swelling thus produced. Its seat is in the loose connective tissue between the scalp and pericranium, and it consists partly of extravasated blood, but largely of serum which has transuded from the congested vessels before that degree of congestion required to effect the transudation of corpuscles or rupture of capillaries was reached. I have repeatedly had an opportunity to examine this tumor in stillborn infants brought from the lying-in wards of the Nursery and Child's Hospital, and have found when it was slight that it consisted almost entirely of serum, but ordinarily when dissected it presented the appearance of a bruise, with a large proportion of serum, the blood and serum infiltrating the scalp to a greater or less distance beyond the appreciable limits of the tumor. Caput succedaneum requires no treatment. As it lies in the loose connective tissue of the scalp, its liquid permeates the open interspaces in this tissue in every direction, and is rapidly absorbed while the tumor disappears. Its subsidence is usually complete within twenty-four hours.

CEPHALHÆMATOMA.—Occasionally during birth blood is extravasated under the pericranium, detaching it from the bone. This commonly occurs in connection with caput succedaneum, and is observed when the latter declines. Its common seat is upon the occipital or parietal bone, near the posterior fontanelle, most frequently upon the parietal, where the pressure during labor is greatest. Prof. Henoch states that the tumor does not obtain its maximum size immediately, but gradually increases by the continued escape of blood until the third day. The tumor may extend over the entire surface of the bone, but does not pass beyond the suture; the suture limits its lateral extension. Cases of bilateral cephalhæmatoma have been reported, but they are rare. The tumor is fluctuating, and the skin covering it has the normal appearance or a bluish tinge, or it may exhibit infiltrations of blood like a bruise. Since the pericranium elevated by the blood does not lose its vitality, it begins to secrete from its under surface preparatory to the formation of bone. In a few days we are able to detect by pressure with the fingers a hard projecting rim at the border of the tumor, the result of the secretion and bony formation at the point where the pericranium is in part detached and in part adherent. If the tumor is tense, we are unable to detect the bone underneath by pressure, and the hard elevated rim resembles the edge of an opening in the skull. The cephalhæmatoma when not disturbed apparently causes little or no suffering, but the infant evinces pain if pressure be made upon it. Usually in the second week absorption is so far advanced that the tumor is less tense, and on pressure the bone can be felt underneath it. Complete absorption of the blood which has remained liquid usually occurs in four or five weeks.

Not infrequently, when absorption occurs slowly, a thin layer of bony substance forms in a few weeks on the under surface of the pericranium. This causes a creaking sound when pressure is made upon it. Some time since a specimen was presented to the New York Pathological Society by me showing a cephalhæmatoma and the mode of cure. The child died about two months after birth, and the blood constituting the tumor, which had been in great part absorbed, was completely encased by the old bone below and the new bony formation above. As the blood becomes absorbed the pericranium, having perhaps a bony formation on its under surface, gradually sinks; the cavity at length becomes obliterated; and there only remains some thickening of that part of the cranium which corresponds with the site of the tumor.

A cephalhæmatoma might be mistaken by the inexperienced for a congenital meningocele, since the ridge described above which forms along its border resembles so closely the edge of an opening, and both tumors are fluctuating; but a meningocele rarely occurs upon the part of the head occupied by the cephalhæmatoma; and if there be any doubt in the diagnosis at first, it will be dispelled in a few days by the changes which it undergoes.

The *treatment* should be expectant, except that a soft covering of cotton should be placed over it to prevent injury. Experienced physicians who formerly opened these tumors by an incision have abandoned this treatment, and recommend leaving them entirely to nature.

INFLAMMATION OF THE STERNO-CLEIDO-MASTOID MUSCLE (Myositis of the sterno-cleido-mastoid muscle; Hæmatoma of the sterno-cleido muscle).—We sometimes observe in infants, usually between the ages of one and six weeks, a hard tumor upon the antero-lateral aspect of the neck, corresponding to the site of the sterno-cleido-mastoid muscle, and evidently developed in this muscle. It is round or more frequently elongated, varying from the size and shape of a pigeon's egg to that of the little finger, occupying the anterior border of the muscle. Sometimes the tumor, hard like cartilage to the touch, extends over the anterior half of the muscle; and it is stated to occur more frequently in the right than in the left muscle. Prof. Henoch observed it on the right side in 16 cases and on the left side in 5 cases.

The following was a typical case: On July 19, 1887, I attended Mrs. S——, a primipara, in her confinement. Her labor, which was tedious, was terminated by the forceps, without any appreciable injury of mother or child. About one month after her confinement the mother stated that she had observed during the last two weeks an unusual swelling passing obliquely along the side of the neck of the child. I found the anterior portion of the sterno-cleido-mastoid muscle thickened and hard from a point about two lines above its lower attachment nearly its entire length. The swelling was of the size and shape of the little finger of a child of twelve years. It was tender to the touch, never had been red, and the infant's condition was normal in every other respect. At the age of nine weeks the tumor was still appreciable, but had nearly disappeared. Sometimes the tumor is not continuous, but the muscle is thickened and hardened in two or three different places. Occasionally the child's head is turned to one side, either from the pain in holding it erect or because the function of the muscle is impaired.

The etiology and nature of this tumor are apparent from the history. In a majority of the cases the birth of the infants affected with this ailment was tedious, and in many the presentation at birth was abnormal. This tumor is especially liable to occur after breech presentation, which necessitates traction upon the neck. In head presentations, when there is delay in liberating the shoulders and traction is made on the head, and especially if forcible rotation is made, the more superficial and exposed fibres in the sterno-cleido-mastoid muscle are liable to rupture; and when this occurs a local myositis occurs, causing the tenderness, infiltration, and swelling. Certain writers state that more or less extravasation of blood occurs at the time of the accident, and before the inflammation supervenes, and hence the term "hæmatoma" which has been employed to designate the disease. But I have seen no evidence of hemorrhage—none of the bluish discoloration so common in bruises which indicates extravasation in any of the cases which I have observed.

The *prognosis* is good. Suppuration does not occur unless under very unusual circumstances, and, though probably more or less cicatricial tissue results at the seat of injury, the function of the muscle is not appreciably impaired when the inflammation and swelling abate. No perceptible contraction or deformity results. But little treatment is required; indeed, patients do well without treatment. But it is best for the infant that it maintain so far as possible a horizontal position, with the head resting on a pillow and with the avoidance of rotation so long as the disease is in its active stage and the tumor is tender to the touch. Probably cool lotions recommended by some are as likely to do harm as benefit by giving cold to the child and producing nasal or other catarrhs. Inunction with an absorbable ointment of iodide of potassium has been recommended for the purpose of promoting absorption, as the following:

℞. Iodidi potass.,	
Aquæ,	*āā*. 1 part;
Adipis,	2 parts;
Lanolin,	6–8 parts.

But without this treatment absorption is progressive, and cure complete within a few weeks.

MAMMARY GLANDS.—In newly-born infants the secretion of a milk-like substance begins at about the fourth day in the mammary glands. It increases until the tenth day, when it gradually diminishes, and disappears at about the twentieth day. It is attended with some swelling of the glands during the period of their activity, and after the secretion ceases the enlargement gradually abates. M. Guillot states that this secretion presents under the microscope the appearance of colostrum.[1] A section of the gland in which this secretion has occurred, made near the surface, shows epithelium. At a greater depth the canals enlarge, divide, and end in cavities which are filled with a liquid having the appearance and character of colostrum. This glandular activity, it is said, may begin before birth, and continue six or eight weeks after birth, but the period of greatest enlargement and most active secretion of the gland is usually between the fourth and tenth days after birth, as stated above.

MASTITIS.—In exceptional instances the enlargement of the gland and its functional activity result more seriously. The gland becomes inflamed, and an abscess may occur as in the adult female. The nurse may produce this result by rubbing and pressing the gland, so that rude manipulation with it should be avoided. An abscess destroys the gland structure, which is a serious result if the infant be a female. M. Bouchut, in his practical treatise on diseases of the newly-born (p. 719, 1867), relates a fatal case of mastitis in which the inflammation extended to the connective tissue, and ulceration so extensive occurred that the pectoral muscle was exposed, and death resulted from prostration. Dr. A. Jacobi has observed similar cases.[1] Therefore in treating the enlarged and secreting gland of early infancy very gentle and unirritating measures should be employed, so that mastitis may, if possible, be avoided. The dress should be loose, so as to avoid pressure on the gland. If no inflammation or inflammation in its commencement be present, absorbent cotton or cotton soaked with sweet oil should be applied and covered with oil silk. It is proper also to apply a mild lead wash to the enlarged mammary gland, especially if it be hot. If it be indolent, iodide of potassium in glycerin, one part of the former to ten of the latter, may be used. If the gland be hot, and especially if it be red, a soft emollient poultice should be applied, as of bread and milk or flaxseed and water. If, unfortunately, suppuration occur, an early incision should be made as far as possible from the nipple. In the subsequent treatment mild antiseptic washes, as boric acid or listerine and water, should be used. Corrosive sublimate should not be employed, as infants are readily poisoned by it, and, for the same reason, carbolic acid should not be used or be used in a very weak solution. Iodoform should also not be used, or used largely diluted by the addition of starch.

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[1] *Archiv de méd.*, 1853.

TETANUS NEONATORUM.—Tetanus or trismus is one of the earliest as well as most fatal diseases of the newborn. In New York City, containing a large laboring population in crowded tenement-houses and shanties, living in disregard of sanitary requirements, tetanus of the newborn is not infrequent, and it appears from statistics to occur in all localities where insanitary conditions exist and the habits of the people are uncleanly. Tetanus is more common in the first and second weeks of life than at any other age; and in at least some localities, if it be not the universal rule, as it probably is, more cases occur in the newborn than in the entire subsequent life. Although tetanus neonatorum has been carefully investigated by many observers, considerable diversity of opinion still exists in regard to its etiology.

I have collated and tabulated the following cases in which the histories were so complete that there could be no error of diagnosis:

FATAL CASES.

1. Male; taken when three days old; lived sixty hours. Labatt, *Edin. Med. and Surg. Journ.*, April, 1819.
2. Female; taken when three days old; lived forty hours. *Ibid.*
3. Taken when five days old; lived fifty hours. *Ibid.*
4. Taken when three days old; lived one day. *Ibid.*
5. Male; taken when two days old; lived two days. Billard, *Treatise on Diseases of Children*, Stewart's trans., p. 477.
6. Male; taken when three days old; lived two days. Romberg.

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[1] *Archives of Pediatrics*, March, 1888.

7. Male; taken when six days old; lived ninety-three hours. Dr. Imlach, *Month. Journ. of Med. Sci.*, Aug., 1850.
8. Female; taken at five days; lived four days. Caleb Woodworth, M. D., *Boston Med. and Surg. Journ.*, Dec. 13, 1831.
9. Negro; taken at seven days; lived twenty-four hours. P. C. Gaillard, M. D., *South. Journ. Med. and Phar.*, Sept., 1846.
10. Male; taken when seven days old; lived one day. Augustus Eberle, M. D., *Missouri Med. and Surg. Journ.*, 1847.
11. Taken when seven days old. D. B. Nailer, *N. O. Med. Journ.*, Nov., 1846.
12. Male; taken when three days old; lived one day. *N. O. Med. and Surg. Journ.*, May, 1853.
13. Negro; taken when three days old; lived three days. Robert H. Chin, M. D., *N. O. Med. and Surg. Journ.*
14. Taken when two days old; died in four hours after the doctor's visit. *Ibid.*
15. Taken when seven days old; lived one day. C. H. Cleveland, *New Jersey Med. Rep.*, April, 1852.
16. Negro; taken when seven days old; death finally. Greenville Dowell, *Amer. Journ. of Med. Sci.*, Jan., 1863.
17. Taken when twelve days old; lived one day. Thomas C. Boswell, communicated to Dr. Sims, *Amer. Journ. of Med. Sci.*, 1846.
18. Taken when about five days old; died at about the age of nine days. B. R. Jones, *Ibid.*
19. Taken at or soon after birth; lived two days. Dr. Sims, *Amer. Journ. of Med. Sci.*, Apr., 1846.
20. Taken at the age of six days; lived one day. *Ibid.*
21. Taken when three days old; lived two days. *Ibid.*
22. Male; taken at the age of eight days; died in three hours. Communicated to the writer.
23. Taken at the age of twelve hours; lived two days. Communicated to the writer.
24. Female; taken when seven days old; lived forty-five hours. The writer.
25. Male; taken at the age of seven days; lived about forty-eight hours. *Ibid.*
26. Female; taken at the age of eight days; lived three days. *Ibid.*
27. Female; taken at the age of five days; lived three days. *Ibid.*
28. Female; taken when four days old; lived two days. *Ibid.*
29. Taken when six days old; died next day. *Ibid.*
30. Taken when five days old; lived twenty-four hours. *Ibid.*
31. Taken when eight days old; lived two days. *Ibid.*
32. Male; taken when five days old; lived one day. *Ibid.*

FAVORABLE CASES.

1. Negro; female; taken when three days old; recovered in a few days. Robert S. Baily, *Charleston Med. Journ. and Rev.*, Nov., 1848.
2. Negro; taken at eleven days; recovered in fifteen days. W. B. Lindsay, *N. O. Med. Journ.*, Sept., 1846.
3. Negro; taken when ten days old; recovered in thirty-one days. P. C. Gaillard, *Charleston Med. Journ. and Rev.*, Nov., 1853.
4. Male; taken at the age of eight days; recovered in twenty-eight days. *Ibid.*
5. Negro; taken at seven days; recovered in fifteen days. Augustus Eberle, *Missouri Med. and Surg. Journ.*, 1847.
6. Taken when eight days old; recovered in four weeks. Furlong, *Edin. Med. and Surg Journ.*, Jan., 1830.
7. Taken at the age of one week; recovered in two days. Dr. Sims, *Amer. Journ. of Med. Sci.*, April, 1846.
8. Female; taken at the age of three days; recovered in five weeks. The writer.

Period of Commencement.—Finckh, who saw cases of tetanus of the newborn in the Stuttgart hospital, states[1] that it began in 1 case on the second day after birth, in 8 on the fifth, and in 7 on the seventh.

Prof. Cederschjold of Stockholm treated 42 cases in hospital practice in 1834, and in these cases it usually commenced between the ages of four and six days. Copland says[2] that it generally commences in the first seven or nine days after birth, and rarely later than the fourteenth. Romberg states that it commences between the fifth and ninth days. In 200 cases observed by Reicke in Stuttgart in the course of forty-two years it was never found to commence before the fifth, rarely after the ninth, and never after the eleventh day. Schneider says that the disease occurs oftenest between the second and seventh, and rarely after the ninth, day. In 6 cases reported by Dr. C. Levy of Copenhagen it began in 2 on the third day, in 2 on the fifth, and in 2 on the sixth. Dr. Greenville Dowell[3] who has seen much of tetanus infantum among the negroes in Mississippi and Texas, says it is almost sure to come on between the fifth and twelfth days after birth. In the 40 cases embraced in the above table the disease began as follows:

Age.	Cases.	Age.	Cases.
One day or under	2	Seven days	8
Two days	1	Eight "	6
Three "	9	Ten "	1
Four "	2	Eleven "	1
Five "	6	Twelve "	1
Six "	3		

Very rarely, as will be seen hereafter, tetanus begins at or so soon after birth that it may properly be called congenital.

Frequency in Certain Localities.—Tetanus infantum occurs probably in all countries, but it does not greatly increase the mortality except in certain localities. Some of the British and Continental physicians, whose observations of disease have been ample, confess that they have seen so few cases that they have almost no personal knowledge of this malady. On the other hand, there are or have been places in every zone where it is or has been so prevalent as to sensibly check the increase of population. The attention of the profession more than a half century since was directed to the prevalence of tetanus in the island of Heimacy, off the coast of Iceland. On this island scarcely an infant escaped, while on the mainland scarcely one was affected. Heimacy, the product of volcanic action, of small extent and almost destitute of vegetation, supports a scanty population. The inhabitants live chiefly on the flesh and eggs of the sea-fowl, and are filthy and degraded in their habits. About the year 1810 the Danish government deputed the *landphysicus* of Iceland to visit Heimacy and ascertain the nature of the disease which was so destructive to the infants. Although this gentleman, from his brief stay, saw no case himself, he obtained interesting particulars in reference to the disease from the priests and parents. At this time scarcely an infant escaped. Again, according to Dr. Schleisner, whose report in reference to the same locality was published forty years later, tetanus was still the most fatal of all infantile maladies.

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[1] *Hecker's Annalen*, vol. iii. No 3, p. 304.

[2] *Medical Dictionary.*

[3] *Amer. Journ. of Med. Sci.*, Jan., 1863.

Tetanus infantum is also represented as very fatal in the island of St. Kilda, off the coast of Scotland. In the temperate regions of America and Europe cases are not frequent, except occasionally in the poor quarters of the cities, in foundling hospitals, and rarely in country towns, where the conditions are favorable for its occurrence. The records of the Dublin, Stuttgart, and Stockholm lying-in asylums furnish many cases. In the town of Fulda, Germany, in 1802, Dr. Schneider saw 6 cases in fourteen days, while a midwife in the same place stated that she had seen more than 60 in nine years.

But the greatest mortality from tetanus infantum is in the warm climates both of the Eastern and Western hemispheres. In the West Indies, the southern portion of the United States, the equatorial regions of South America, and in the islands of Minorca and Bourbon, it has in many localities been the most frequent and fatal of infantile maladies.

It is an interesting fact that in the warm regions of the United States the victims are chiefly negro infants. L. S. Grier, M. D., of Mississippi, says in the *N. O. Med. and Surg. Journ.*, May, 1854: "The first form of disease which assails the negro among us is trismus. The mortality from this disease alone is very great. No statistical record, we suppose, has even been attempted, but from our individual experience we are almost willing to affirm that it decimates the African race upon our plantations within the first week of independent existence. We have known more than one instance in which, of the births for one year, one-half became the victims of this disease, and that, too, in spite of the utmost watchfulness and care on the part of both planter and physician. Other places are more fortunate, but all suffer more or less; and the planter who escapes a year without having to record a case of trismus nascentium may congratulate himself on being more favored than his neighbors, and prepare himself for his own allotment, which is surely and speedily to arrive." Dr. Wooten[1] says: "It is a disease of fatal frequency on the cotton plantations in this section of Alabama." He has, however, never seen a white child affected with it.

In New Orleans, according to the death-statistics in our possession—which, however, relate to only one year—tetanus infantum is the most fatal of all diseases except phthisis. Mr. Maxwell says, in the *Jamaica Physical Journal*,[1] "From observations that I have made for a series of years . . . . I found that the depopulating influence of trismus neonatorum was not less than 25 per cent. It scarcely has a parallel within the bills of mortality." This gentleman's observations relate to the West Indies. Similar statements are made in reference to this malady as it occurs in Cayenne and Demerara in South America.

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[1] *N. O. Med. and Surg. Journ.*, May, 1846.

While tetanus infantum prevails in regions wide apart and presenting very diverse climatic conditions, there is a similarity as regards the personal and domiciliary habits of the people who suffer most from its occurrence. It occurs chiefly among those who are filthy and degraded in their habits—who live, either from choice or necessity, in neglect of sanitary requirements.

Causes.—That uncleanliness and improper air are a cause of tetanus is as fully demonstrated as most facts in the etiology of diseases. The attention of the profession was forcibly directed to this cause by Dr. Joseph Clarke in a paper read before the Royal Irish Academy in 1789. This physician was in charge of the Dublin Lying-in Asylum, and had rightly concluded that the mortality among the newborn infants was due to imperfect ventilation. Through his advice, apertures twenty-four inches by six were made in the ceiling of each ward; three holes, an inch in diameter, were bored in each window-frame; the upper part of the doors leading into the gallery were also perforated with sixteen one-inch apertures; and the number of beds was reduced. The results of these simple sanitary regulations may be seen from Dr. Clarke's own statement. He says: "At the conclusion of the year 1782, of 17,650 infants born alive in the Lying-in Hospital of this city, 2944 had died within the first fortnight; that is, nearly every sixth child." The disease in 19 cases out of 20 was tetanus. After the wards were better ventilated—namely, from 1782 till the time of the preparation of Dr. Clarke's paper—8033 children were born in the hospital, and only 419 in all had died, or about 1 in 19. So impressed was Dr. Evory Kennedy, who at a later period had charge of the same asylum, with the belief that Dr. Clarke had discovered the true cause and had been able in great measure to prevent it, that he thus expresses his convictions: "If we except Dr. Jenner, I know of no physician who has so far benefited his species, making the actual calculation of human life saved the criterion of his improvements." The cases occurring in my own practice have almost all been in tenement-houses, where habits of cleanliness are not observed, and I have not yet seen in the practice of others nor heard of a case which occurred in the better class of domiciles. The statement of physicians in the Southern States, who speak from extensive observation among the negroes, are strongly corroborative of the opinion that the disease is in great measure due to uncleanliness and impure air.

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[1] Copied in the *London Lancet*, April 11, 1835.

Dr. Greenville Dowell of Texas states that he has been able to trace tetanus infantum to the bed-clothes saturated with excrementitious matters which are found in the negro cabins. In a paper published in the *Nashville Journ. of Med. and Surg.*, June, 1851, by Prof. John M. Watson, the frequency of this disease among the negroes is accounted for as follows: "When called to see their children we find their clothes wet around their hips, and often up to their armpits, with urine. . . . . The child is thus presented to us when, on examination, we find the umbilical dressings not only wet with urine, but soiled likewise with feces, freely giving off an offensive urinous and fecal odor, combined at times with a gangrenous fetor arising from the decomposition, not desiccation, of the cord."

Another cause is believed to be some irritation in the intestines, as from retained meconium. Observers in the Southern States and elsewhere occasionally mention this as a cause. In one case treated by myself there was obstinate constipation immediately before the attack, and in another diarrhœa preceded and was the only apparent cause.

In certain cases the assignable cause is exposure to wet or cold or to a variable temperature, which also occasionally produces tetanus in the adult. Prof. Cederschjold attributed the epidemic which he observed in Stockholm to a sudden change of temperature from hot weather in May to frosty in June. In a case related by Dr. P. C. Gaillard in the *Southern Journ. of Med. and Pharmacy*, Sept., 1846, the disease commenced as follows: The nurse came in with wet apron and clothes in the evening; a short time after she had taken the child into her lap it sneezed violently two or three times. At 10 P. M. tetanus began. In certain localities on the Continent where there are no parish churches the frequent occurrence of tetanus has been attributed by the physicians to the practice of carrying the infants to a distance to be christened, thus exposing them to the winds. In this city I have observed tetanus after a similar exposure. The influence of the weather in the production of tetanus of the newborn is also shown by facts observed in the Stuttgart hospital. In an aggregate of 25 cases treated in that institution, all but 3 occurred in the cold months. In the island of Cayenne, at a hamlet surrounded by mountains and dense forests, tetanus attacked only 1 in every 12 or 15 of the infants. After a great part of the forests had been cut down, so as to allow access to the cold sea-winds, almost all the newborn infants fell victims to tetanus.[1]

Hein relates that a citizen of Berlin lost successively two children with tetanus soon after birth. When the second child fell ill he observed that its cradle was exposed to a current of air. At the third accouchment the position of the cradle was changed and the infant escaped. Exposure to wet and cold has been long recognized as a cause of the disease. According to Sauvages, "Hic morbus hieme et cum aurâ humidâ sæpius advenit quam sicca æstate."[1]

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[1] *Insel. Cayenne.*

The causes of infantile tetanus, enumerated above, may be proximate or remote—may produce the disease by their direct effect on the system or indirectly by causing a pathological state which in turn leads to the development of the disease. There are other direct causes—namely, organic affections. In the bodies of the newborn who die of tetanus lesions are observed which doubtless result from the spasms. Again, others are found which from their nature could not be a result, and which, being observed in different cases, are to be regarded as causes. The most frequent of such lesions is inflammation of the umbilicus or umbilical vessels.

Moschion, who lived in the first century of the Christian era, stated in writings still extant that stagnant blood in the umbilical vessels sometimes produced dangerous disease in the newborn infant; and it is supposed, though this is doubtful, that he referred to tetanus. In modern times the attention of the profession was more particularly directed to this cause by a paper published by Dr. Colles in the first volume of the *Dublin Hospital Reports* in 1818. The observations contained in this paper were made in the Dublin Lying-in-Hospital during the period of five years. In each of these years he had witnessed from three to five post-mortem examinations in cases of infantile tetanus, and the lesions, he states, were in all much alike, as follows: The floor of the umbilical fossa was lined by a membrane apparently formed by suppurative inflammation, and in the centre of this fossa was a large papilla. This papilla consisted of a soft yellow substance, apparently the product of inflammation, and in all the cases the umbilical vessels were in contact with this substance and were pervious. In a few instances superficial ulcerations were found near the mouth of the umbilical vein, and occasionally the skin surrounding the umbilicus was raised. The peritoneum covering the vein was highly vascular, often not to a greater distance than an inch above the umbilicus, but sometimes as far as the fissure of the liver. The peritoneum in the course of the umbilical arteries presented the inflammatory appearance in still greater degree, sometimes as far as the sides of the bladder. The connective tissue lying along the arteries and urachus anteriorly was loaded with a yellow watery fluid. The inner surface of the umbilical vein was not inflamed, but its coats, in general, were thickened. On slitting open the arteries a thick yellow fluid resembling coagulable lymph was found within their coats, and in all cases these vessels were thickened and hardened as far as the fundus of the bladder.

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[1] *Nosol. Method.*, vol. i. p. 531.

Dr. Finckh, who observed 25 cases in the Stuttgart hospital, believes that the most frequent cause was suppuration or ulceration of the umbilical cord. In 10 of the 25 cases the navel was dry and cicatrized; in the remainder it was either wet or swollen, with a bluish-red inflamed edge at the margin of the navel; a dirty viscid pus covered the umbilical depression.

Dr. Levy, physician of the Foundling Hospital in Copenhagen, attended 22 cases in that institution in 1838 and 1839. Of these, 20 died, and 15 were examined carefully after death. In 14 there were decided marks of inflammation in the umbilical arteries, especially those portions lying along the urinary bladder; in several cases the peritoneum over the arteries was much injected, and in 3 adherent either to the omentum or intestine by coagulable lymph; the coats of the arteries were thickened, their cavities dilated and containing dark reddish-brown or greenish puriform matter, always fetid. Sometimes the arterial tunica interna was found ulcerated and absent in places, and there was spongy thickening of the subjacent connective tissue. In 2 cases the ulcerative process had extended from the tunica interna to the peritoneum, and there was a deposit of thick ichorous matter around the ulcer; in 1 case both arteries were so softened that their coats were scarcely distinguishable, and in another these vessels had become gangrenous. The appearance of the umbilicus was unchanged in 4 cases; in 10 the fundus was red and filled with puriform fluid, which quickly reappeared when removed, and, in general, shortly before death the navel presented a greenish color.

According to Romberg, Dr. Schöller made post-mortem examinations in 18 cases of tetanus infantum, and in 15 found inflammation of the unbilical arteries. These vessels were swollen near the bladder, in 1 case to the diameter of four lines, and were found to contain pus. The lining membrane was eroded or covered with an albuminous exudation. Both arteries were not always equally inflamed, and in 3 cases only one was affected.

Schneeman found minute points of suppuration in the umbilical vein in 8 cases,[1] and pus throughout the course of this vessel in 1.

The observations mentioned above were made, for the most part, in hospitals on the Continent, but similar observations have been made in private practice. M. Borian of the isle of Bourbon says that he has found in every case inflammation around the umbilicus.[2] Dr. John Furlong,[3] who resided at St. John's, Antigua, attributes the disease to improper dressing of the umbilicus. The same opinion is expressed by Mr. Maxwell, who also saw the disease in the West Indies.[1] Dr. Ransom states, in a communication to Prof. John M. Watson,[2] that he has never seen a case of tetanus of the newborn in which the umbilicus was healthy. In a case related by Robert S. Bailey in the *Charleston Med. Journ. and Rev.*, Nov., 1848, there was a hard scab on one side of the umbilicus, and this part was much distended. A discharge followed the removal of the scab, and the child recovered. In a favorable case related by W .B. Lindsay in the *N. O. Med. and Surg. Journ.*, Sept., 1846, the umbilicus was tumid and not disposed to heal. Dr. H. O. Wooten (same journal, May, 1846) attributes the disease to the condition of the umbilicus and umbilical vessels, and states that he has found the umbilicus gangrenous. In a case related in the *N. O. Med. and Surg. Journ.*, May 1, 1853, the umbilical vessels were blocked up by purulent matter. Robert A. Chime, M. D., Brazoria, Texas,[3] believes one cause of the disease to be improper tying and management of the umbilical cord, by which a diseased state is produced which extends to the umbilicus and thence to the viscera. At a meeting of the Obstetrical Society of Edinburgh, held April 24, 1850, Dr. Imlach related a case in which there was a dark and gangrenous appearance on the integument around the umbilicus, and the peritoneum underneath was also dark, but not inflamed; umbilical vein healthy; a little fibrin in the left umbilical artery; right umbilical artery much diseased; its two inner coats apparently destroyed, and in their place a yellow pultaceous slough, in which pus-globules were discovered with the microscope.

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[1] *Holscher's Annalen*, vol. v. p. 484, 1840.

[2] *Gaz. médicale*, Paris, July 11, 1841.

[3] *Edin. Med. and Surg. Journ.*, Jan., 1830.

Two cases in which tetanus apparently originated from disease of the umbilicus were reported in the *Medical Times*, Dec., 1884, by Mr. Golden. In the first case tetanus began on the seventh day after birth, the child refusing the breast and tetanus being well marked. In a few hours the spasms were severe and frequent. The umbilicus, which had a dirty, neglected appearance, discharged a sanguineo-purulent liquid, and bled when touched. The cord had not separated. Death occurred in eighteen hours. In the second case the disease did not occur until the fourteenth day, when the characteristic tetanic rigidity of the muscles indicated the nature of the attack. Occupying the site of the umbilicus was a red, irregular, sloughy sore, which had existed nearly from birth. The temperature rose to 106.4°, and the child died asphyxiated in a wasted state.

Recently, Dr. F. M. Wright of Nottingham, England, has related two cases in which the cause was apparently located in the umbilicus.[4] Mrs. D——, having six healthy children, gave birth to a boy on Jan.

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[1] *Jamaica Phys. Journ.*, copied into the *London Lancet*, April 11, 1855.

[2] *Nashville Journ. of Med. and Surg.*, June, 1851.

[3] *N. O. Med. and Surg. Journ.*, Sept., 1854.

[4] *Brit. Med. Journ.*, May 22, 1886.

6, 1883. He was robust and his appearance normal, but the cord had three or four times its ordinary size, and had a darker color than usual. On the sixth day the umbilicus and the parts in immediate relation with it were inflamed, and on the seventh day the inflammation had increased and the cord separated. The child progressed favorably a few days, when it refused the breast; its jaws became fixed, and its whole body rigid from head to foot. It had spasms in which the tonic convulsions were increased. Death resulted. In 1886, Mrs. D—— lost another newborn infant from tetanus, but the cause may not have been located at the umbilicus, which presented the normal appearance.

Since umbilical inflammation has been observed in so many cases of tetanus neonatorum, there can be little doubt that it sustains a causal relation to it in those cases in which it occurs. It seems probable, in the light of recent investigations, that the umbilical disease has a microbic origin, and hence its comparative frequency in families and domiciles where the air is impure from habitual uncleanliness and a disregard of sanitary requirements. (See art. "Sepsis.")

But cases of tetanus of the newborn occur in which no umbilical disease can be detected. Dr. Finckh of Stuttgart examined the umbilical vessels in 11 cases without discovering any pathological change. Dr. Samuel B. Labatt, master of the Dublin Lying-in Hospital, published in the *Edin. Med. and Surg. Journ.*, April, 1819, a paper entitled "An Inquiry into an Alleged Connection between Trismus Nascentium and certain Diseased Appearances in the Umbilicus." This paper was designed as a reply to the essay of Dr. Colles. Dr. Labatt relates several cases in which there was no disease of the umbilicus and umbilical vessels, and others in which the disease was so slight that it probably produced no injurious effect on the health of the child. Dr. James Thompson, who spent considerable time in the tropical regions, says:[1] "I have myself examined nearly 40 cases of infants that have sunk under this complaint. In many I have looked at no other part but the navel, and have found it in all states—sometimes perfectly healed, especially if the infants had lived several days; at other times a simple clean wound. When death occurred on the fifth or sixth day the wound was frequently in a raw state. I never yet saw it in a sphacelated condition." This writer concludes from his observations that there are cases in which the cause is located elsewhere than in the umbilicus or umbilical vessels. In the *Dub. Journ. of Med. and Chem. Sci.*, Jan., 1836, Dr. John Breen remarks: "From dissections . . . . we have never been able to discover any peculiar morbid appearance which would justify us in offering any explanation of the pathology of the disease." In my own cases there was no evidence of disease of the umbilicus or umbilical vessels, so far as could be ascertained by external examination, and in one (No. 32) a careful post-mortem examination disclosed no lesion of these parts.

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[1] *Edin. Med. and Surg. Journ.*, Jan., 1822.

The inference from the above observations is that, although umbilical disease is an occasional, probably not infrequent, cause of tetanus infantum, cases occur in which such disease is not present, and we must look for the cause elsewhere. From the nature of tetanus infantum the cerebro-spinal axis has been from time to time examined in those who have died of this malady, and occasionally sufficient cause has been found in this part of the system.

I have alluded in another connection to a case from Billard in which tetanic rigidity occurred in an infant three days old as the result of spinal meningitis. That tonic spasms not infrequently occur in older children in consequence of meningeal inflammation is well known, and in some of the reported epidemics of infantile tetanus meningitis was really present, and was doubtless the cause of the spasms. Such an epidemic was observed by Prof. Cederschjold in Stockholm in 1834. Within a few months he treated 42 cases, and in addition to the lesions which are known to result from tetanus he found in the bodies examined a plastic exudation at the base of the brain. Finckh of Stuttgart made 20 post-mortem examinations of those who had died of this disease, and in 9 found spinal meningeal inflammation.

Meningitis in the newborn is, however, rare, and we must regard it as an exceptional cause of tetanus.

In 1846 there appeared from the pen of Dr. Sims, then practising at Montgomery, Alabama, a paper designed to show that tetanus of the newborn is produced by pressure exerted on the nervous centre through depression of the occipital bone. In 1848 the same writer published a second paper, also in the *Amer. Journ. of Med. Sci.*, fully enunciating his theory as follows: "That trismus neonatorum is a disease of centric origin, depending on a mechanical pressure exerted on the medulla oblongata and its nerves; that this pressure is the result, most generally, of an inward displacement of the occipital bone, often very perceptible, but sometimes so slight as to be detected with difficulty; that this displaced condition of the occiput is one of the fixed physiological laws of the parturient state; that when it persists for any length of time after birth it becomes a pathological condition, capable of producing all the symptoms characterizing trismus neonatorum, which are instantly relieved simply by rectifying this abnormal displacement and thereby removing pressure from the base of the brain." In both papers cases are narrated in support of this theory. Recently, Dr. J. F. Hartigan,[1] has advocated Sims' theory. He says if any one doubts its correctness, let him make pressure on the occiput with the fingers, and convulsions can be produced at will. But there are serious objections to this mode of explaining the occurrence of the disease. In the first place, if this explanation were correct, tetanus ought ordinarily to occur sooner, for the occiput is as much depressed previously as, and in the majority of cases more depressed than, at the period when it does actually commence. Pressure on the medulla would certainly be followed by immediate and marked symptoms, instead of an immunity for four or five days.

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[1] *Med. Journ.*, Jan. 3, 1885; *Arch. of Pediatrics*, March 15, 1885.

Again, well-known facts in reference to the causation of tetanus infantum conflict with Dr. Sims' theory, as, for example, epidemics of the disease, its prevalence in one locality and absence in another, although no particular attention be given to the position of the infant; the diminution of the number of cases by greater attention to cleanliness, of which there is abundant proof. Moreover, there are many reported cases of this disease at the commencement of which there was no perceptible displacement of the occipital bone.

The inequality of the cranial bones often observed in tetanus infantum should, in my opinion, be explained as follows: When the newborn infant becomes emaciated the volume of the brain is diminished, like that of the trunk or limbs, and the sinking of the occipital bone simply corresponds with the amount of waste in the cerebral substance. Whatever the disease in the young infant, if there be much emaciation the parietal bones will usually be found more prominent than the occipital. Now, in fatal tetanus infantum emaciation is very rapid; those fleshy and plump, if the disease do not speedily end, become pinched and wrinkled. Viewed in this light, the occipital depression should be regarded as a result, and not a cause, of the tetanus.

Although we do not accept the theory which attributes tetanus infantum to occipital depression, there are a few cases on record in which it was apparently due to injury of the head received at birth. Dr. Sims has related one such case, that of a negro infant. The mistress, an observing lady, gave to Dr. Sims the following account of it: Its head was "mightily mashed. . . . . The bones seemed to be loose. I got it to take a little boiled milk on the first day, but it swallowed very little, and very badly, for its jaws seemed to be locked, On the next day it took spasms and got stiff all over; its hands were shut up tight, and its arms were bent up so (she placed her forearms at right angles). Every time I touched it the spasm would get worse all over, screwing up its face till it was the ugliest thing in the world; and when the spasms wore off it looked as well as any other newborn baby. But then the stiffness never left it, and the spasms kept on coming and going till it died." It lived two days.

It is evident, from the description given by the mistress, that this was a case of tetanus commencing at or so soon after birth that it seemed almost congenital. The apparent cause was injury of the head occurring in consequence of protracted birth, the infant being resuscitated with difficulty after several minutes.

Dr. W. C. Sutton published a similar case in the *Nashville Journ. of Med. and Surg.*, April, 1853. The infant at birth was apparently dead, but was resuscitated so as to live eighteen hours in a state of tetanic rigidity. In cases in which tetanus begins at birth, doubtless the cerebro-spinal axis is in some way affected; but in the absence of post-mortem examinations the exact nature of the lesion is uncertain.

It is evident, therefore, that in this disease, as in eclampsia, the cause in different cases may be entirely distinct. Dr. James Johnson many years ago expressed his belief in the multiplicity of causes, and he had been a careful and intelligent observer in the West Indies.

The causes may be arranged in two groups—one external, the other internal. In the first group should be placed imperfect ventilation, personal and domiciliary uncleanliness, and atmospheric vicissitudes; in the second group, so far as ascertained, inflammation of the umbilicus and umbilical vessels, meningitis, and, rarely, injury of the cerebro-spinal axis during birth.

The lesions resulting from tetanus infantum pertain chiefly to the circulatory system. In the cases examined by Prof. Cederschjold of Stockholm, already alluded to, the meningeal and cerebral vessels and those of the spinal cord, the cavities of the heart, and the large vessels connected with the heart, were distended with blood.

Anatomical Characters.—Finckh made post-mortem inspection of 20 cases in the Stuttgart hospital, the bodies at death having been placed on their faces in order to prevent any deceptive appearance from the gravitation of blood. In 4 of the cases the spinal cord and its meninges presented the normal appearance. In the remaining 16 there was effusion of blood in considerable quantity the whole length of the spinal cord, between the bony walls and the dura mater. It should be stated, however, that spinal meningeal inflammation was present in 9 of the 16, though the extravasation did not probably result from the inflammation, but from the tetanus. The blood in Finckh's cases was very dark—sometimes fluid, at other times coagulated. In 1 case no anatomical change was observed in the brain or its membranes. In the remaining 19 more or less extravasated blood was found on the surface of the brain or in its interior. The substance of the brain was healthy, as also its membranes, except the congestion. The only abnormal appearance observed in the thoracic and abdominal viscera was strong contraction of some portion of the intestinal tube in 5 cases. Dr. West says: "The most frequent post-mortem appearances in these cases"—referring to tetanus infantum—"and that which I found in the bodies of all the four children whom I observed, consists of effusion of blood, either fluid or coagulated, into the cellular tissue surrounding the theca of the cord. Conjoined with this there is generally a congested state of the vessels of the spinal arachnoid, and sometimes an effusion of blood or serum into its cavity. The signs of congestion about the head are less constant, though much oftener present than absent, and sometimes existing in an extreme degree; while in one instance I found not merely a highly congested state of the cerebral vessels, but also an effusion of blood in considerable quantity between the skull and dura mater, and also a slighter effusion into the arachnoid cavity." Dr. Weber of Kiel also placed infants who had died of tetanus on their faces, and, without exception, found injection of the capillaries of the cord and spinal meninges and extravasation of blood. M. Matuszynski, according to Bouchut, "has observed effusions of blood of variable quantity in the cerebral pia mater, in the ventricles, and in the choroid plexuses, with considerable injection of the membranes of the brain. He had also seen serous infiltration beneath the arachnoid, and serous effusion into the ventricles, accompanied by a diminution of the consistence of the cerebral substance." In two cases examined by myself there was intense injection of the cerebral meninges and of the meninges of the upper part of the spine, but no extravasation was noticed. The spinal canal was not opened. In a third case, in which the spinal cord was opened, extravasation of blood and marked congestion of the vessels were observed in and under the spinal meninges.

Dr. H. O. Wooten[1] states that he has made several post-mortem examinations, and has found the pathological appearances as uniform as in any other disease, as follows: "Engorgement of the substance of the brain and of the meninges lining the base of the brain, the medulla oblongata, and spinal marrow; liver congested."

In a case related by Dr. Imlach before the Edinburgh Obstetrical Society, April 24, 1850, the upper part of the lungs was healthy, the posterior portion congested and containing many dark points; heart and liver healthy; small intestines of a light-brown color; stomach and large intestines pallid; there had been umbilical hemorrhage.

Romberg states that he found in a child whose death occurred from this disease such intense congestion of the veins and sinuses of the brain that a slight touch and the removal of the cranial bones produced extravasation of the partly coagulated and partly fluid blood. Dr. Schöller, on the other hand, found an actual extravasation of blood in the spinal canal in only 1 case in 18.

At the autopsy of a case treated by Dr. Godler, related above, the umbilical ulcer present was found to have no communication with the abdominal cavity; brain very soft; fluid blood in longitudinal and lateral sinuses; dura mater healthy; pia mater hyperæmic; a small quantity of fluid in ventricles; small punctate hemorrhages; the dura mater firm and the internal surface smooth; a small quantity of thick, clear fluid in cavity of arachnoid; pia mater injected and somewhat adherent to the cord; cord hyperæmic and soft; no other abnormal appearances observed.

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[1] *N. O. Med. and Surg. Journ.*, May, 1846.

It is seen from the above observations that tetanus of the infant is ordinarily accompanied by great passive congestion, which is especially marked in the cerebro-spinal axis, and that frequently extravasations occur from the distended capillaries. The embarrassment of respiration and the retarded circulation of blood consequent on the tetanic rigidity afford sufficient explanation of this state of the vessels.

Symptoms.—In many cases premonitory symptoms are absent or are so slight as to escape notice. Sometimes there is a degree of fretfulness previously, but no more than is often observed in those who continue in good health. The first symptom which alarms the parents and shows the grave nature of the commencing disease is inability to nurse or evident pain and hesitation in nursing. Commencing with rigidity of the masseters, the disease gradually extends to the other voluntary muscles, and in the course of a few hours the muscles of the limbs as well as of the trunk are involved. Persistent muscular contraction, which is the pathognomonic feature of infantile tetanus, is developed not fully in the beginning, but by degrees in each affected muscle, so that it is not till after the lapse of several hours, perhaps even a day, that the greatest amount of rigidity is attained. Therefore, in the commencement of the disease the limbs can be bent and the jaws pressed open more readily than at a subsequent stage, though with manifest pain to the infant.

During the period of maximum rigidity the jaws are fixed almost immovably, often with a little interspace between them, against which the tongue presses and in which frothy saliva collects. The head is thrown backward, and held in a fixed position by the stiffness of the cervical muscles. The forearms are flexed; the thumbs are thrown across the palms of the hands and are firmly clenched by the fingers; the thighs are drawn toward the trunk; the great toes are adducted and the other toes flexed. Occasionally opisthotonos results from the extreme contraction of the dorsal and posterior cervical muscles. The infant can sometimes be raised, without any yielding of the muscles, by one hand under the occiput and the other under the heels.

The rigidity is liable to variation in its intensity, even after the full development of the disease. If the infant be quiet, especially if asleep, the muscles are partially relaxed to such an extent sometimes, in the first stages of the complaint, that the features have a placid and natural expression, though only for a short time. There are frequent exacerbations in the muscular contraction, sometimes occurring without any apparent cause, and sometimes produced by anything which excites or disturbs the child. Attempts to open the lips or jaws or eyelids or to bend the limbs, blowing on the face, or even the crawling of a fly upon it, occasions the paroxysm.

During the paroxysm the eyelids are forcibly compressed, as well as the lips, which are either drawn in or are pouting; the forehead and cheeks are thrown into wrinkles, and the physiognomy is indicative of great suffering. The unnatural conditions of the trunk and limbs which result from the muscular contraction are increased for the moment; the head is more forcibly thrown back and the limbs more strongly flexed. The muscular movements which occur during the paroxysms are sometimes described as clonic spasms. There is indeed occasionally some quivering of the limbs, and yet, as I have on different occasions noticed, so far from the muscular action being a clonic spasm, it is clearly tonic, and is intensified during the paroxysm. In fatal cases the paroxysms occur more and more frequently until the period of collapse.

The crying of the child affected by tetanus is never loud, however great the suffering. It is variously described by writers as "whimpering" or "whining." It is of this suppressed character in consequence of the rigid state of the respiratory muscles and their imperfect movement.

During the exacerbation respiration is suspended, or so imperfect and the circulation so retarded that the surface becomes of a deep-red, almost livid color. Sometimes epistaxis occurs, affording partial relief to the congestion, and sometimes, though less frequently, the blood forces itself from the congested liver along the umbilical vein and escapes from the umbilicus. The intense passive congestion consequent on the tetanic spasm is general throughout the system, but extravasation of blood appears to be more common around the brain and spinal cord than elsewhere.

The frequency of the pulse and respiration varies in different cases and at different stages of the same case. It is often somewhat accelerated, but at other times is natural, or is even slower than in health.

While the appetite of the infant, to appearance, is not diminished, the pain which it experiences in nursing is such that alimentation is necessarily deficient. It can be fed with a spoon for a time after it ceases to take food in the natural way, but artificial feeding soon fails. The milk placed in its mouth is in great part pressed back through the violence of the spasm which is induced by the attempt to feed it.

In consequence of imperfect nutrition the infant rapidly wastes away. There is no other disease except the diarrhœal affections in which ema-

ciation is so rapid. In a case related by Dr.
N. O. Med. Journ., Sept., 1846, the record st
was fat three days before, but was now emaci
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information was obtained from the parents and
proximate cause of the disease in Heimacy wo
in the cerebro-spinal axis. Contraction of the p
in the stage of collapse.

Mode of Death.—Death in infantile tetanus n
in the paroxysms, from extreme congestion of
apoplexy; and, lastly it may occur from exhaus
probably the most frequent.

Prognosis.—All writers till recently agree tha
rarely terminates favorably. Cullen attributes
sicians in regard to this disease to the fact th
able to treatment that they are not usually sur
affected with it. In the island of Heimacy, o
during a series of years about the commencemen
tury, not one survived; and in the same locality,
islet, 64 per cent. of all the infants born died
reports in regard to the mortality of tetanus i
physicians in the Southern States. Dr. H. O.
says[3] that he has "never seen a decided case
that did not prove fatal, ... and that it is
useless to call in medical aid after the initiator
declared." Mr. Maxwell, speaking in referenc
says:[4] "From observations which I have mad

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[1] *N. O. Med. and Surg. Journ.*, Sept., 1854.

[3] *N. O. Med. Journ.*, May, 1846.

[4] *Jamaica Phys. Journ.*, copied into the *London Lancet*, A

. . . . I found that the depopulating influence of trismus nascentium was not less than 25 per cent. It scarcely has a parallel within the bills of mortality." Dr. D. B. Nailer[1] says: "About two-thirds of the deaths among the negro children are from this disease, and so uniformly fatal is it that a physician is never sent for."

Yet death does not always result. 8 of the 40 cases in my collection recovered; but a correct opinion cannot be formed from this of the actual ratio of favorable to unfavorable cases, since favorable cases are much more likely to be published. In the history of these 8 cases two interesting facts were noticed, which when present may serve as a ground for hope of a successful termination. These were the age at which the disease began and fluctuation in the symptoms. With two exceptions the infants which recovered were about a week old when the initiatory symptoms appeared, and there were fluctuations in the gravity of the symptoms, whereas fatal cases ordinarily grow progressively worse. Yet in favorable cases the symptoms are never so severe as they become in a few hours in those who succumb.

Duration in Fatal Cases.—Of 18 cases observed by Finckh in the Stuttgart hospital, 15 died in 2 days, 2 in five days, and 1 in seven days. During the epidemic in the Stockholm hospitals in 1834, where 42 cases were treated, the disease seldom lasted more than two days. Romberg says: "It generally lasts from two to four days, but its duration is at times limited at from eight to twenty-four hours, and occasionally, though rarely, it extends from five to nine days."

In 31 fatal cases in my collection, in which the duration is mentioned,

1 lived	3 hours.
11 others lived	1 day or less.
12 lived	2 days.
4 lived	3 days.
3 lived	4 days.

Both Underwood, who published a treatise on the diseases of children in 1789, and Dr. Elsässer, at a more recent date, record fatal cases which were unusually protracted. The one described by Underwood was treated in the British Lying-in Hospital, and, although all the others treated in this institution died by the third day, this lived six weeks; but it is suggested by the author that death was due in part to some other affection. The child treated by Elsässer lived thirty-one days.

Duration in Favorable Cases.—In the 8 favorable cases in my collection the duration of the disease, reckoned from the time when the infant ceased nursing till it began again, was as follows: In 1 case two days; in 1, a few days; in 1, fourteen days; in 2, fifteen days; in 1, twenty-eight days; in 1, twenty-one days; and in the remaining case, about five weeks.

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[1] *N. O. Med Journ.*, Nov., 1846.

Diagnosis.—To one who has seen tetanus of the newly-born or is familiar with its symptoms diagnosis is easy. The symptoms which possess diagnostic value are more manifest and reliable than in most other infantile maladies. Permanent rigidity of the voluntary muscles, with temporary exacerbations, such as have been described above, which are induced by any cause which disturbs the infant, as attempts to open the mouth or eyelids, is pathognomonic.

Preventive Treatment.—While tetanus infantum, if fully developed, is ordinarially fatal in spite of any remedial measures heretofore used, there is no doubt of the efficacy and value of preventive measures when properly employed. This was shown by the great reduction in mortality in the Dublin Lying-in Hospital through the thorough ventilation introduced by Dr. Clarke. Dr. Meriwether of Montgomery, Ala., says:[1] "When the disease appears endemically on a plantation it may be arrested by having the negro houses whitewashed with lime inside and out; by raising the floors above the ground; by removing all filth from under and about the houses; by particular attention to cleanliness in the bedding and clothes of the mother and in the dressing of the child, so as to prevent any of the matter from the umbilicus lying long in contact with the skin." Many physicians, especially in the Southern States, speak confidently of care in dressing the cord and attention to the umbilicus as a means of prevention. In the *N. O. Med. and Surg. Journ.*, July, 1853, Dr. Grafton says that he has "never known the disease to occur in any child whose navel had the turpentine dressing." He uses turpentine as follows: "At the first time a few drops of the undiluted turpentine are applied immediately to the umbilicus around the cord, and it is anointed at every succeeding dressing, the turpentine being diluted one-half or two-thirds with olive oil, lard, or fresh butter." This use of turpentine has also been recommended by other practitioners in the warm regions.

Dr. John Furlonge of St. John's, Antigua, believes[2] that no case would occur with the following treatment: "The cord, when divided, should be wrapped in clean linen. Every night for two weeks one or two drops of tinct. opii and spts. vini, equal parts, should be given, and castor oil, with a little magnesia, every morning. The child must be washed in tepid water every morning, and the funis dressed." If this treatment be attended by the success which is claimed for it by Dr. Furlonge, so great care in dressing the cord is certainly well repaid in localities, as at Antigua, where a large proportion of the infants die of tetanus.

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[1] *Amer. Journ. of Med. Sci.*, April, 1854.

[2] *Edin. Med. and Surg. Journ.*, Jan., 1830.

Probably the inflammations located at the umbilicus which have a causal relation to tetanus are septic, due to pathogenic microbes and the ptomaïnes which they produce. Evidently, to prevent septic poisoning and the consequent tetanus antiseptic dressing of the cord and umbilicus is required. The dusting of a powder of starch and iodoform or starch and salicylic acid in and around the umbilical fossa three or four times daily would probably sufficiently protect the umbilicus from septic infection.

Some experienced observers go so far as to assert that it is possible to ward off tetanus infantum after the occurrence of premonitory symptoms. Dr. Dowell says:[1] "Some with slight twitchings of the muscles have recovered without any trouble by being put into a mustard-bath, washed clean, and put in a clean and well-ventilated cabin."

Treatment.—In considering the effect of medicinal agents which have been employed in the treatment of infantile tetanus the great difficulty which the child experiences in swallowing should be borne in mind. Without care a considerable part of the dose is lost by the spasm of the muscles of deglutition which ordinarily occurs when the spoon is placed in the mouth, so that, unless special attention be given to this matter, it is uncertain whether the prescribed dose is fully administered.

The treatment employed by different physicians has been very diverse. Antiphlogistic remedies were prescribed by Finckh, but every case so treated was fatal. He states that whenever blood was abstracted, even in small quantities, the symptoms were aggravated. The same result has followed depletory measures in the practice of other physicians.

The internal remedies which have been most frequently prescribed are opiates and antispasmodics. Furlonge in a favorable case gave laudanum in doses of one drop every three hours, alternately with two grains of Dover's powder. Woodworth also gave one-drop doses of laudanum; Eberle, one-sixth of a drop hourly. The opiate has generally been given in combination with an antispasmodic. The Dover's powder given every three hours by Furlonge was combined with five grains of sulphate of zinc. The hourly doses of laudanum by Eberle were combined with six drops of tincture of assafœtida.

When anasthetics began to be employed in the treatment of diseases, it was believed that they would be especially useful in cases of tetanus. Accordingly, chloroform has been used in tetanus in the infant, with the effect of controlling the spasm during the time of its use, but without curing the disease. In Case 7 in our first table it was employed several times, but apparently without delaying the fatal result. The editor of the *New Orleans Medical and Surgical Journal* states, in the May issue of that periodical for 1853, that he has used chloroform in tetanus infantum, with the effect, he believes, of prolonging life. Anæsthetics certainly relieve the suffering of the infant, and on this account, even if they do not prolong life, their judicious employment seems proper.

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[1] *Amer. Journ. of Med. Sci.*, January, 1863.

The remedy which, in my opinion, is far preferable to all others is hydrate of chloral. Since the introduction of this agent into therapeutics it has been employed by several physicians in the treatment of this disease, with so good a result that it will probably supersede all other medicines for this purpose. Dr. Widerhofer of Vienna states that he has saved 6 out of 10 or 12 by the use of chloral.[1] He prescribes it in doses of one to two grains by the mouth, or if there be great difficulty in swallowing two or four grains by the rectum. Dr. F. Auchenthales relates a case[2] in which he gave even six-grain doses, and in nine days the disease had entirely disappeared. I have recently employed hydrate of chloral in a case of tetanus, giving it in half-grain doses every two hours, except when there was profound sleep. The disease was fully developed and the symptoms severe when I was called. I did not believe that the infant with the old remedies would live more than two days, but by the chloral life was prolonged nearly one week. Moreover, by the use of chloral the suffering of the infant is greatly diminished. The frequent inhalation of sulphuric ether also aids materially in controlling the spasms.

Dr. Deghilage employed ether and chloral per rectum in a case of tetanus neonatorum, and the child rapidly grew worse, so as to appear in danger of immediate death. He then used ether by inhalation, and artificial respiration was employed from time to time by means of a tube inserted into the nostrils. Pieces of mustard-leaves were also applied to the chest, and the child was laid on its side. In a few hours the patient's condition improved markedly. Profuse perspiration occurred, and the spasms entirely ceased and convalescence occurred.[3]

The administration of alcoholic stimulants is required at short intervals on account of the rapid emaciation and great prostration.

Local treatment directed to the umbilicus in those cases in which there is evidence of inflammation of the umbilicus or umbilical vessels should not be neglected. The application of an emollient poultice to the umbilicus has been followed by apparent improvement, if we may believe the statement of some physicians who have made use of this treatment. Dr. Meriwether of Alabama says that if there be no improvement from the medicine which he orders he applies a blister, larger than a dollar, to the umbilicus, and with this treatment the child generally improves—a remarkable statement, since so few improve at all.

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[1] *London Lancet*, March 18, 1871.

[2] *Jahrb. f. Kinderheil.*, N. S. iv.

[3] *London Lancet*, Sept. 24, 1887.

A warm foot-bath, repeated at intervals of a few hours, and stimulating embrocations along the spine, are proper adjuvants to the treatment.

CONJUNCTIVITIS (Ophthalmia Neonatorum; Purulent Conjunctivitis of the Newly-born).—Different forms of conjunctival inflammation occur in the newly-born. In the mildest variety no appreciable swelling of the lids occurs, and only a little viscid secretion collects between the lids, which agglutinates them in sleep, and which the nurse readily removes by bathing them with tepid water or milk and water, and in a few days effects a cure. On the other hand, the purulent form of conjunctivitis, which is observed on the second or third day after birth, and which arises from the reception between the lids of the vaginal secretion of the mother, always involves great danger to the eye, speedily producing opacity or destruction of the cornea, unless promptly and properly treated. Between these two extremes conjunctivitis neonatorum occurs in different grades of severity.

Mild or Catarrhal Conjunctivitis.—This, as the name indicates, is a simple catarrh, attended, as stated above, by a slight viscid secretion from the lids and by little or no swelling. The secretion collects in the angles of the lids and along their margin. This mild conjunctivitis requires very simple treatment. Warm water or milk and water should be gently applied by a large camel's-hair pencil, so as to wash away the secretion as soon as it forms, and sweet oil or vaseline applied between the lids. With these simple measures this mild conjunctivitis disappears in a few days.

If the secretion be more abundant and the lids perceptibly swollen, more active measures are required. Prof. Noyes states that there is a variety of catarrhal ophthalmia neonatorum which requires active treatment. In the cases alluded to the ocular surface is but slightly involved, having little or no hyperæmia, but the palpebral conjunctiva is hyperæmic and the fornix thickened and swollen. The swelling of the fornix is the most marked anatomical character. The secretion has a watery appearance, and the lids are but slightly tumefied. The cornea does not become hazy and the sight is not impaired, but the watery discharge and the viscid secretion on the borders of the lids continue for weeks, unless the case be promptly attended to. Prof. Noyes recommends for this form of catarrhal ophthalmia neonatorum the application several times daily of the boric-acid solution:

℞. Acidi borici,	gr. xv;
Aquæ,	℥j. M.

He adds: "But if a child is a month old and the discharge continue, and the fornix exhibit decided swelling, I have been obliged to use solutions of tannin and glycerin as strong as ℈ij. ad ℥j. before the condition would yield. I had tried nitrate of silver in mild solution, and, unwilling to make it more caustic, had taken a solution of tannin gr. x, ad glycerini ℥j, but this had only a temporary good effect, and the disease was not subdued until the strong solution was applied. It was done every second day to the everted lid, and was of course quite painful."

Purulent Ophthalmia Neonatorum; Gonorrhœal Ophthalmia Neonatorum.—This is one of the most important diseases to which the neonati are liable, since, if not promptly and properly treated, it is very destructive to the eye, permanently impairing or totally destroying vision. It is produced by the lodgment in the eye of irritating matter, usually the gonorrhœal vaginal secretion of the mother. A minute amount of the virulent matter is sufficient to set up the inflammation. Recent observations seem to show that in a considerable number of cases the poisonous matter is received, not during birth, but in the washing, or subsequently from the fingers of the nurse or mother, or through the medium of soiled towels or linen. Dr. Joseph A. Andrews in an interesting paper on contagious eye disease published in the *New York Medical Journal*, 1855, quotes the following table from Theremin, showing the time of commencement in 476 cases, as follows:

First to fourth day after birth	57	cases.
Fourth to eighth day after birth	134	"
Eighth to fourteenth day after birth	94	"
Later	194	"

When the disease begins subsequently to the first week after birth, it is evident that the infection occurs after birth, the poison being conveyed to the eyes through the soiled fingers or sponges or cloths employed in the nursery, as stated above.

The infectious principle contained in the gonorrhœal discharge of the mother is now admitted to be a micro-organism, designated the gonococcus, discovered and described by Hallier in 1869 and Salisbury in 1873. The attention of the profession was especially drawn to it by Herr Neisser of Breslau in 1879, whose description of it was more full and accurate than that of his predecessors. Recently it has been carefully examined with the aid of coloring tests by C. W. Allen and E. C. Wendt of New York City, and their monograph relating to it is one of the best yet published. The gonococcus is a "comparatively large" microscopic organism, round at first, but becoming elongated or oval, and then dividing by fission so as to become a diplococcus. Subsequently division in the opposite direction occurs, and this process continues until the pus-cell in which the gonococci lie is filled with these organisms. It is within the pus-cells, as we have stated, and not on their exterior, that the segmentation and development of the gonococcus take place; but diplococci may be observed in the intercellular fluid, probably having escaped from the pus-cells.

In acute gonorrhœa usually no other or but few other bacteria except the gonococcus are observed; but in chronic gonorrhœa of both sexes other microbes are commonly present in addition to the gonococcus. That the contagious and virulent property of gonorrhœal pus is due to the gonococcus seems to be fully established, but were the action of this organism limited to cases of gonorrhœa it would be less important as a pathological factor. Microscopic examinations show its presence in the pus of ophthalmia neonatorum, as well as in the vulvitis of childhood, when of gonorrhœal origin, and the intense inflammation and rapid destruction of sight in the former disease are believed to be due entirely to its agency.

Dr. Gayet, professor of ophthalmic surgery, Lyons, France, says that the detection of the gonococcus in infected pus is as simple and easy as that of albumen in albuminuria. He places a particle of pus on a glass slide, covers it by another slide, and presses the two together. They are then separated, and stained by dropping on them an alcoholic solution of methyl-blue mixed with an equal quantity of water. After two minutes the slides are washed freely with water, and each leucocyte is seen to have two, three, or four nuclei, "this being a special character of the disease, the increase in the number of nuclei heralding the approach of the gonococci, which will be observed as intensely blue spherical bodies in the interior of some of the leucocytes."[1] If the gonococcus be found in a single leucocyte, of course the diagnosis is established.

Symptoms.—Stellwag says: "The period of incubation after successful inoculation of the contagious material varies between some hours and days. The outbreak of the blenorrhœa follows the more quickly the more favorable are the conditions for the inoculation—*i. e.* the more powerfully the secretion was able to act." In most instances when infection occurs during birth some evidence of the disease appears as early as the second or third day. The inflammation is from the first severe. The conjunctiva, ocular and palpebral, is intensely hyperæmic; chemosis soon occurs in most instancss, and an abundant muco-purulent or purulent secretion flows between the lids mixed with tears. The inflammatory hyperæmia not only extends over the entire conjunctiva, but also to the connective tissue and the integument of the lids, causing in the latter a dusky or bluish-red tint. At a later stage the tint may be yellowish-red. The eyelids swell rapidly in consequence of the looseness of their connective tissue and the great amount of infiltration, so that they appear as projecting tumors pressing against each other and upon the eye, concealing the latter from view. The ocular conjunctiva, from the great amount of serous exudation underneath, rises up like a circular wall around the cornea, which appears sunken in the centre of the swelling, and sometimes only its central part is visible in consequence of the bulging of the swollen conjunctiva over it. The palpebral conjunctiva is so swollen from the serous infiltration that it bulges forward on attempting to separate the lids, and eversion of them is liable to occur. From the great amount of tumefaction of the lids the palpebral fissure is closed, and the upper lid may project over the lower so as to nearly cover it.

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[1] *La Province médicale; Lond. Lanc.*, June 18, 1887.

The danger to the eye results chiefly from the chemosis, or hard and tense œdema, of the subconjunctival areolar tissue, which by its pressure may obstruct circulation. The eye is photophobic, tender to the touch, and the seat of severe pain. The intensity of the inflammation gives rise to active fever. The inflammation, having reached its maximum, soon begins to abate under correct treatment; the bright-red erysipelatous hue of the lids changes to a bluish color; the heat and tenderness abate. The secretion is abundant, and is constantly escaping from the conjunctival sac and flowing over the cheek, which is often reddened in consequence of its extreme acridity. If in the height of the inflammation we attempt to separate the lids, which are firmly pressed together not only in consequence of the great amount of tumefaction, but also from the spasmodic contraction of the orbicularis palpebrarum, the purulent secretion gushes forth, consisting of greenish or grayish pus—a thick liquid containing flocculi of epithelial cells and muco-pus. Occasionally, when the inflammation is intense, these flocculi contain also fibrin. The discharge, consisting chiefly of muco-pus mixed with tears, has a creamy appearance, but if the lachrymation be abundant it may resemble whey in color and consistence, especially in the declining stage.

Course; Results.—Purulent conjunctivitis of the newborn usually begins in one eye, and unless the sound eye be immediately and efficiently protected, the inflammation ordinarily soon attacks this eye. Of course both eyes may be simultaneously affected, but in a large proportion of patients there is an interval of a day or two in the commencement of the inflammation in the two eyes, that secondarily infected receiving the virus from the one first attacked.

In the milder cases the inflammatory symptoms, the hyperæmia, tumefaction, heat, and secretion increase gradually, and it is not until the fifth or sixth day that they attain their maximum. In severe cases the symptoms reach their height by the close of the second or third day. The inflammation having attained its maximum, as indicated by the heat, swelling, and abundant secretion which wells up between the lids, soon begins to abate under correct treatment. But several weeks elapse before the normal state is restored, a simple catarrhal inflammation continuing after the purulent and infective secretion has ceased.

The danger to the eye depends upon the severity of the inflammation. If the chemosis be not great, and the swelling be more œdematous than indurated, and the amount of secretion moderate, the eye is usually saved by timely and correct treatment. In severe inflammation characterized by great chemosis, hyperæmia, and heat, and an abundant purulent discharge, the peril to the eye is imminent, since the inflammation is likely to extend from the conjuctiva to the cornea, and ulceration result. When the cornea becomes cloudy in places the danger to the eye is extreme, but the sight may be preserved, though abscesses and ulcers occur, provided that they are small and involve only a part of the cornea. Abscesses and ulcers near the margin of the cornea are less dangerous than those in the centre, but crescentic peripheral ulcers are of bad import, since they are likely to increase. If marginal softening and a central abscess or ulcer coexist, the sight will probably be lost. Of course the more quickly the inflammation is subdued the better the prognosis.

Preventive Measures.—Since purulent conjunctivitis of the newborn is so rapid in its progress and so destructive to the eye, it is very important that its occurrence should so far as possible be prevented, and, fortunately, it is a preventible disease. The employment of efficient preventive measures is one of the recent achievements in midwifery practice. Statistics abundantly show the need and efficiency of such measures. At the meeting of the Blind Congress, held in Paris in 1879, F. Dumas stated that of 1178 blind patients whom he had treated, 1070 became blind from curable diseases, and of this number 817, or 69 per cent., lost their sight from ophthalmia neonatorum.

According to Horner, of the blind children treated in the institutions of Germany and Austria, from 20 to 79 per cent. lost their sight from this disease.[1] This was before the efficient prophylactic measures now in use were employed.

Inasmuch as this malady is produced by the infective vaginal secretion of the mother coming in contact with the eye of the infant at birth, the use by the mother of antiseptic and disinfectant vaginal douches before and during parturition is suggested as the appropriate preventive treatment in case she have a muco-purulent discharge. For this purpose carbolized vaginal infections have been employed, with the result of diminishing the number of cases of ophthalmia neonatorum. Mules[2] advises the following very judicious and important preventive measures: "1st. Cure all cases of chronic vaginal discharge before labor. 2d.

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[1] *Archiv für Gynäkologie*, 1883.

[2] Prize Essay, *Manchester Chronicle*, Jan., 1888.

Irrigation of the vagina during the second stage of labor when vaginitis is known to exist. The solution used for this purpose in Queen Charlotte's Hospital is corrosive sublimate (1 : 2000). The copious secretion of a clear vaginal fluid before and during labor, and the flow of the liquor amnii just before the birth, diminish the danger. 3d. Assist the fœtal eyes to pass beyond the perineal edge without resting. This is easily done by hooking around the perineal edge with the fingers and drawing it down. 4th. By wiping the eyes with a clean cloth at birth of head. 5th. By instilling an antiseptic solution into the eyes at birth if the mother has a discharge. 6th. Credé's method: to wash the face first; never in water in which the body has been washed. 7th. To retain one sponge or flannel specially for the child's face, and insist on scrupulous cleanliness. 8th. The nurse to wash her hands after adjusting the mother before touching the child. 9th. Not to expose child unduly to draughts, bright light, etc. 10th. To protect the child from flies with a thin veil. 11th. To remove carefully the child from the presence of another similarly affected; strict isolation of an infected case. 12th. To guard the one eye if the other is affected. The 10th and 11th rules are evidently applicable to cases in maternity wards, rather than to those in private practice.

But in order to gain the highest degree of success by preventive measures it has been found necessary to treat the eyes of the infant immediately after birth if there be the least reason to suspect the presence of an infective vaginal discharge in the mother, so as to destroy the poison if it have lodged in them. In the lying-in asylums where, in consequence of the prevalence of gonorrhœa in the mothers, ophthalmia neonatorum of a severe form has been prevalent, antiseptic treatment of the eyes of all the newly-born has either entirely prevented this disease or rendered it of rare occurrence. To Credé of Leipzig more than to any other physician the credit belongs of having established this treatment. Its efficacy is now universally recognized.

Bathing the eyes of infants immediately after birth was previously practiced by Abegg, who employed only water, and by Olshausen, who, through Von Graefe's advice, employed a 1 per cent. solution of carbolic acid. Although this treatment diminished the number of cases of ophthalmia, it was far surpassed in efficiency by that recommended by Credé, who in 1880 began to treat the eyes of the newly-born in the following manner: The external surface of the lids was first washed with plain water; the lids were then separated, and a single drop of a 2 per cent. solution of nitrate of silver was allowed to fall upon the cornea from the end of a glass rod. From 1880 to April 1, 1883, Credé treated 1160 infants in this way, and only 4 became affected with ophthalmia neonatorum. This treatment by nitrate of silver, employed in other institutions in Europe and in this country, has been followed by signal success. Thus, Dr. Garrigues of New York employed Credé's treatment in the Maternity Hospital on Blackwell's Island, where ophthalmia neonatorum had previously been of common occurrence, and of 351 infants born consecutively "not a single one was affected."[1] Dr. Garrigues adds that in these cases occasionally a thin discharge like serum followed the application of nitrate of silver, due apparently to its irritating action, and that the first cases in which he observed this discharge he treated with iced compresses and the instillation of a saturated solution of boric acid. But afterward he found that they quickly recovered without such measures. Occasionally so many drops of the nitrate were inserted by accident that a black ring was produced upon the eyelids, without any ill effect to the eye. Dr. Garrigues recommends Credé's method of employing a glass rod, to which a single drop of the solution adheres, so that there is no risk that more than this amount will be instilled. The application should be made as soon as the infant is removed from the bed to the lap of the nurse. She should first clean the eyelids and the face, and in washing them should be careful that none of the wash enters the eyes. A weaker solution of nitrate of silver has been employed without the good results which follow the use of the 2 per cent. solution. Credé made tentative use of borate of sodium (1 : 60), and found it greatly inferior as a preventive to the nitrate of silver.[2]

Of course preventive treatment of this kind should not be recommended in general midwifery practice, except when there is evidence or strong suspicion that the mother has gonorrhœa. Moreover, much can be done toward diminishing the number of cases of blindness resulting from ophthalmia neonatorum by disseminating among the masses a knowledge of the imminent danger to the sight of the newly-born infant when a purulent discharge occurs from its eyes, so that instead of employing domestic remedies the parents will seek at once the advice of the accoucheur or family physician.

Treatment.—No disease of early life so imperatively requires early, persistent, and correct treatment as the purulent form of ophthalmia neonatorum. If proper measures be employed sufficiently early and persistently, the eye can nearly always be saved. Since this malady has a microbic origin, it is evident that an efficient germicide is required in the treatment—an agent that does not injure the eye, while it destroys the cause of the inflammation. Various germicides have been employed for this purpose, but the two which have been found safest and at the same time most efficient are corrosive sublimate and nitrate of silver.

The late Prof. S. D. Gross long before the microbic causation of the infectious diseases was known, and before antiseptic treatment had come into use, had in his large clinical experience discovered the efficacy of the corrosive-sublimate treatment. In his *System of Surgery*, published in 1859, he wrote: "In the purulent ophthalmia of infancy I have usually effected excellent and even rapid cures by the injection every few hours of tepid water or milk and water, followed immediately after by a solution of bichloride of mercury, from the eighth to the twelfth of a grain to the ounce of water;" and again he wrote: "The bichloride of mercury is, of all the local remedies that I have ever tried in this affection, the most efficacious in its action, making generally a most rapid and decided impression upon the discharge." Oppenheimer of Heidelberg in his experiments on the gonococcus, which he cultivated in blood-serum, found that corrosive sublimate, 1 : 40,000, retarded its development, and 1 : 20,000 destroyed its vitality.[1] Nitrate of silver was also used in the treatment of purulent ophthalmia neonatorum long before the gonococcus was discovered, and before the need and efficacy of germicide remedies in the treatment of the infectious diseases were known or recognized. Von Graefe more that thirty years ago everted the lids when it was possible, applied the mitigated stick of nitrate of silver to the mucous surface, washed it with salt, and replaced the lids. This treatment is still employed by some specialists in ophthalmic practice. Dr. Gayet[2] everts the lids so as to stretch the mucous membrane, when he thoroughly washes the folds of the conjunctival sac by means of a ball syringe. The lids are replaced, rubbed so as to displace pus-cells and force them into the conjunctival sac, again everted and syringed. The mitigated stick is then applied to the palpebral mucous membrane, and the nitrate of silver immediately neutralized and washed away by a solution of chloride of sodium. The lids are then replaced. In the subsequent treatment the mother or nurse washes the eye with a solution of corrosive sublimate (1 : 6000), and frequently renews upon the lids compresses wet with ice-water. But most of the leading oculists employ nitrate of silver in solution in the manner presently to be described.

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[1] *Amer. Journ. of Med. Sci.*, Oct., 1884.

[2] *Arch. f. Gynäk.*, xxi. p. 193.

We again call attention to the necessity in this disease, more than in almost any other, of employing faithful and attentive nurses, who will carry out punctually the directions given. Two nurses are required—one to serve by day and the other by night—since it is essential that the eye be frequently cleaned and the secretion washed away.

If the conjunctivitis be purulent, but mild, and attended by a slight discharge and little or no appreciable swelling of the conjunctiva, two drops of a 2 per cent. solution of nitrate of silver should be instilled once between the lids, and the lids moved to ensure its flowing underneath them:

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[1] Andrews: *N. Y. Med. Journ.*, Sept. 25, 1886.

[2] *La Province médicale*, *London Lancet*, June 18, 1887.

℞. Argent. nitrat., gr. vj;
Aq. destillat., ℥v. M.

In the subsequent treatment a strong solution of boric acid—some recommend a saturated solution—should be instilled every half hour, the lids being drawn widely apart. The frequent wide separation of the lids, which can be accomplished without undue pressure upon the eye, is useful in allowing the pus to escape, as well as in facilitating the application of the wash. I prefer, however, unless the disease yields quickly, the use of a weak solution of corrosive sublimate in place of the boric acid, employing the following formula:

℞. Hydrarg. chlor. corros., gr. j–ij;
Aquæ destillat., Oj. M.

The use of this mild solution of the sublimate every second hour after a single employment of the nitrate of silver usually suffices to cure mild cases in a few days.

If the disease be more severe, but still mild, and accompanied by moderate tumefaction and a moderately increased secretion, a single daily application of the nitrate of silver suffices during the active period of the inflammation. In severe forms of the disease, accompanied by much tumefaction and the frequent gushing out between the lids of a thick, purulent secretion, the nitrate-of-silver solution should be used as often as every six hours. Dr. David Webster of the Manhattan Eye and Ear Hospital states that he has employed the nitrate of silver in these severe cases five times in twenty-four hours with great benefit. As regards the frequency of the application of nitrate of silver, and the time when to desist from its use, Andrews writes: "The only guide which I know is the condition of the conjunctiva. When there is slight hyperæmia only, the slough produced by the nitrate of silver requires a long time to be cast off," and it is very irritating. But if there be a more severe inflammation, with much swelling, the slough is thrown off in a few hours. The use, therefore, of nitrate of silver at intervals of a few hours should be practised only in the most severe forms of the inflammation, while in the milder cases it should be used only once or at long intervals. In the declining period of the disease the application of a solution of boric acid or a weak solution of corrosive sublimate, gr. 1 to the pint of distilled water, suffices to effect a cure.

Icterus Neonatorum.—Icterus, or a yellowish discoloration of the skin, is common in the newly-born. It has even been said that in its mildest form it is present in the majority of infants, and it arises from a considerable number of anatomical and pathological conditions. It occurs in its worst and most intractable form when there is congenital obliteration of the bile-ducts; it is believed to occur sometimes in the youngest infant from the same cause as that which produces the usual form of adult jaundice—to wit, catarrh of the duodenum extending by propagation into the bile-ducts and narrowing or occluding their lumina. Congenital syphilis is another cause, the icterus being probably produced by the newly-formed connective tissue which compresses the bile-ducts. The *modus operandi* of the causes related above is easily understood, but a large proportion of the neonati who have the icteric hue in a slight or mild form do not appear sick, and fully recover after a few days. The cause in such cases is probably of a trivial nature, else it would produce a more profound impression on the system. West says of these mild cases in which there is no appreciable impairment of the health that the yellow tinge of the skin comes on about the third day, deepens for a day or two, and subsides gradually, "the bowels acting properly and the urine not being high-colored: though to this condition the name of jaundice has been applied, it is yet no real jaundice, but is merely the result of the changes which the blood in the over-congested skin is undergoing, the redness fading, as bruises fade, through shades of yellow into the genuine flesh color." A yellow coloring of the skin, the result of cutaneous hyperæmia, is not accompanied by the diagnostic signs of true jaundice, such as a yellow conjunctiva, clay-colored stools, and biliary coloring matter in the urine. Inasmuch as the liver and other internal organs are not concerned in producing this form of icterus, West says it has been proposed to designate it by the term "local icterus." It would be interesting to ascertain in cases in which there is a deposit of pigment in the skin, while all the other organs, including the liver, are in their normal state and have their normal functional activity, whether there has been a cutaneous plethora due to late ligature of the cord. Zweifel states that the placenta before the uterus contracts after the expulsion of the child, and the cord is still beating, contains six ounces of blood, but if the cord have ceased to beat and the uterus be firmly contracted, half of this amount of blood, or three ounces, passes through the cord and augments to this extent the quantity of blood in the vessels of the fœtus. Late ligature, therefore, when there is firm uterine contraction, increases the fulness of the blood-vessels in the child, and, according to Park, babies with distended blood-vessels exhibit a more intense jaundice.

H. Quincke advances another and in some respects a plausible theory of the etiology of the common form of icterus neonatorum.[1] He attributes the jaundice to the continued patency of the ductus venosus. Henry Ashby says[1] that in a minority of cases of jaundice of the newborn the clinical history or post-mortem examinations reveal the cause, as when it arises from congenital defects, syphilitic hepatitis or cirrhosis, septicæmia or hæmaglobinuria. But the usual form of infantile jaundice, which begins on the second or third day, and commonly ends favorably, Ashby states, has nothing in common with the above fatal forms. He does not accept West's and Murchison's theory of a merely cutaneous icterus, and believes that Quincke's theory is the most plausible yet presented for consideration. The ductus venosus normally closes between the second and fifth days after birth, but if it remain pervious and the circulation from any cause be retarded, bile, according to the above theory, enters the branches of the portal vein and finds its way into the general circulation through the ductus venosus. In one case, says Ashby, an infant had jaundice from the second to the eleventh day, and at the autopsy the ductus venosus was large enough to admit an ordinary director. This theory also comports with the fact that feeble infants are more liable to become jaundiced than the robust, for those vascular canals which pertain to the fœtal state and are obliterated after birth are more likely to remain a longer time pervious in the feeble than the robust.

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[1] *Archiv für experimentelle Pathologie und Pharmakologie,* xix. 1 and 2.

Dr. Alois Epstein[2] made many experiments in order to determine whether bile-pigment occurs in the urine of icteric newly-born infants. He agitated the urine with lime-water, filtered it with alcohol, and added sulphuric acid. If bile-pigment be present a green color results. He discovered in the urine a pigment in the crystalline or amorphous state, and of a yellow or yellowish-red color. It occurred in the various forms of tufted needles or small tables, yellowish or brownish, and in yellowish-red amorphous granulations. Epstein was able to distinguish by chemical reactions this pigment from uric acid and the urates. On further investigation he states that he found this pigment in all the organs, abundantly in the kidneys, and also in the blood. Does this pigment have an hepatic or hæmic origin? Epstein is led by his investigations to believe that this crystalline or amorphous pigment results from changes occurring in the blood, and probably from the liberation of the coloring matter by the destruction of the red corpuscles, which Neumann, Kölliker, Denis, Hayem, and others have shown to occur so abundantly in the neonati.

Epstein believes that any marked impairment of the important functions in the system tends to increase the destruction of the red corpuscles, the consequent release of its coloring matter, and the formation of the crystalline or amorphous pigment described above, which in icterus escapes into the tissues. Marked impairment of respiration, circulation, and calorification, artificial alimentation, prematurity, protracted and difficult birth, taking cold, and similar agencies, in proportion as they impair the general health and produce perturbation in the system, increase the destruction of red corpuscles, and thereby act as causes of icterus. Epstein also mentions the well-known fact that the children of parents who have grave constitutional diseases or live under bad hygienic conditions are especially liable to become icteric, and that septic infection is an important cause of those alterations in the blood which give rise to icterus.

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[1] *Lond. Med. Times and Gaz.*, April 25, 1885.

[2] "Ueber die Gelbsucht bei Neugeboren Kindern," *Sammlung klinischer Vorträge*, No. 80, 1880.

The peculiar character of the blood of the newly-born is believed by good observers who have investigated this subject to predispose to the occurrence of jaundice. According to Hofmeier, the red blood-corpuscles in the neonati are more spherical than in adults, and do not show a tendency to form rouleaux. The white corpuscles are often more numerous than in adults; they are viscid, deliquescent, easily destroyed, and have a tendency to aggregate in rouleaux. The investigations of Ponfick and Silbermann[1] show that the red corpuscles of the newborn readily part with their coloring matter, the hæmaglobin, under disturbing agencies, such as syphilis, burns, taking cold, injudicious nursery management, and even by the action of certain medicinal agents, as glycerin and pyrogallic acid. The red corpuscles, which have lost their coloring matter by its transferrence to the plasma, either disintegrate and disappear, or they appear under the microscope as pale rings which have been designated shadows. This transference of the coloring matter from the red corpuscles to the liquor sanguinis, and the disintegration of red corpuscles, which characterize the first few days of infant life, lead to an increase of hæmaglobin in the plasma (hæmaglobinæmia) and of fibrin ferment. Silbermann summarizes his views, derived from an examination of the character of the blood and the blood-changes occurring in the newly-born, as follows: "The blood of the newly-born holds corpuscles which vary greatly in size, and also the so-called shadows: it is richer in fibrin ferment than the blood of adults; these peculiarities are due to the liberation of hæmaglobin and its transfer into the plasma; the richness in fibrin ferment of the blood of the newly-born predisposes to disease; all disease-processes in the newly-born which involve great destruction of the albumen in the circulation are especially dangerous to life." These investigatious relating to the blood will aid to an understanding of the views of Silbermann regarding icterus.

Dr. Silbermann concludes[2] an elaborate paper on icterus neonati with the following aphorisms: "1st. Icterus of the newly-born is an icterus of absorption. 2d. The biliary engorgement has its seat in the biliary capillaries and the interlobular bile-ducts, which are compressed by the dilated branches of the portal vein and the capillary blood-vessels of the liver. 3d. This engorgement in the vessels is effected by the change in the circulation of the liver which occurs soon after birth, and is one of the indications of a general change in the blood-plasma. 4th. This change, which is induced by the destruction of many blood-corpuscles soon after birth, consists of a kind of blood-fermentation. 5th. The more feeble the infant the more intense will be the icterus, for in such a child the destruction of corpuscles, and the consequent blood-changes, will be much more decided than in a vigorous child. 6th. As the consequence of the destruction of so many red corpuscles there is abundant material for the formation of biliary coloring matter, and under the influence of the fermentation-process alluded to this accumulates in considerable quantity." Therefore, according to this theory, free coloring matter in the blood derived from the abundant destruction of the red corpuscles which attends the first days of infancy, occurs in such quantity that it cannot be disposed of in the biliary secretion or otherwise eliminated, and is deposited in the tissues, causing the icteric hue.

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[1] "Zur Hämatologie der Neugeborenen," *Jahrbuch für Kinderheilkunde*, 1887.

[2] *Archiv. für Kinderheilkunde*, 1887.

Birch-Hirschfeld[1] attributes icterus of the newborn to œdema of the capsule of Glisson, and consequent compression of the bile-ducts. This œdema he believes is due to diminution of pressure in the portal system consequent on section of the cord.

That feebleness, insanitary conditions, and exposure are a cause of jaundice, however they may act to produce such a result, is shown by many observations. West, as we have stated above, describes a local or cutaneous icterus resulting from plethora of the skin, and having no special interest or importance, and a systemic or general icterus, which he states "does not affect perfectly healthy children who have been born at the full time, have been nourished exclusively at the mother's breast, and been sheltered from cold without being overburdened with clothing or confined in a vitiated atmosphere." In corroboration of this statement he alludes to the fact that in the Dublin Lying-in-Hospital, where the utmost care is bestowed on the foundlings, icterus is rare, while it is so common in the Foundling Hospital of Paris that few escape. In the latter institution, as compared with the former, the exposures are much greater and the conditions as regards hygiene are greatly inferior.

M. Bouchut says that icterus is observed in 80 to 90 per. cent. of the newborn; that Levret, Breschet, Billard, and Valleix regard it as the result of ecchymosis of the skin following congestion—an opinion which he considers erroneous. He believes that it almost always results from a mild or severe hepatitis consequent on ligature of the cord. The ligature, he says, produces a mild inflammation which is propagated to the liver and causes obstruction of the bile-ducts. In his articles on hepatitis of the newborn he repeats his belief in this theory.

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[1] *Virchow's Arch.*, 1882, Band lxxxvii.

The obvious inference from the above résumé of opinions is that icterus neonatorum results from different causes in different instances, and that it is a mild or grave disease according to its etiology. The various causes admit of classification in two groups: 1st, the hæmatogenous; 2d, the hepatogenous. The hæmatogenous theory, which attributes the common form of icterus of the newly-born to the destruction of the red blood-corpuscles in the first days of life, and the escape of its coloring matter into the circulation, is advocated by such men as Billard, Virchow, Breschet, Porak, Violet, and Epstein. The hepatogenous theory has also advocates of equal reputation. The etiology of this disease certainly requires further investigation, and when it is better understood it will probably be seen that distinct pathological states in the newly-born have been described under the term "icterus."

Prognosis.—This depends on the nature of the cause as well as the present state of the infant. If the cause be susceptible of removal, as in the common mild form of icterus, a favorable prognosis is justified. The most unfavorable cases are those in which there is absence of the biliary ducts or their permanent occlusion. In severe forms of the disease in which the connective tissue, the secretions, and transuded serum have the yellow hue the prognosis should be guarded.

The common mild form of icterus, appearing on the second or third day after birth, disappears or is scarcely appreciable at the close of the second week. Severe icterus, continuing longer without any abatement in its intensity, is due as a rule to permanent anatomical conditions which prevent the flow of bile into the intestine, and is probably incurable. In these cases the stools remain clay-colored, the icterus increases, and vomiting may occur.

The *treatment* is simple, and to a considerable extent expectant. Gentle friction over the liver may perhaps in some cases aid in removing the obstructive disease in the bile-ducts. The use of hydrarg. cum creta in small doses, as recommended by West, is of doubtful efficacy. It is evident that preventive measures are more important and more efficacious than the curative, since every measure which promotes a healthy parentage and the health and robustness of the infant tends to diminish the frequency of this disease. Those who, like Porak, believe that congestion of the skin at birth is a common cause of the simple form of jaundice recommend an early ligature of the cord, when the umbilical arteries are still beating or have just ceased to beat, since when the arteries are beating an equilibrium is maintained in the circulation, whereas in a late ligature, when the uterus is firmly contracted and the arteries have for some time ceased to beat, a plethoric state of the vessels is more likely to occur.

UMBILICAL VEGETATIONS.

Not infrequently small excrescences sprout out from the base of the umbilical depression at the time or soon after the fall of the cord. They have the appearance of those vegetations which arise from open sores, and which have been designated, in common parlance, proud flesh. One of the first, if not the first, monograph on these outgrowths appeared in the *Medical Dictionary* in 1834 from the pen of M. Dugès. They have been designated in different languages by many appellations, as fungous excrescence of the umbilicus (Condie), excrescence of the umbilicus (Cooper Foster), warty tumor of the umbilicus (Holmes), bourgeonnement de l'ombilic (Depaul), granulome de l'ombilic (Dechamber), végetation ombilicale (Guersant). Virchow has also alluded to them in his treatise on tumors, and a carefully-prepared and instructive monograph relating to them appeared in the *Rev. Mens. des Malad. de l'Enfance*, Juillet, 1886, from the pen of M. Broussole.

The size attained by these growths is always small. Many of them are not larger than a pea in their greatest development. Their form appears to be determined in a measure by the external pressure. Some are rounded, and others are elongated or cylindrical. French physicians have likened them, as regards appearance, to a small strawberry or a small cherry, and sometimes, when small and elongated, they have been likened in shape to a grain of wheat or barley. Guersant and Owen have described them as having a nipple- or polypus-shape according to variations in their base. It is only in exceptional instances that they have so red a tint as the strawberry or cherry. Their color varies from a pale red to a red of a deeper tinge according to the degree of vascularity, and they are always moist.

This outgrowth is distinguished by its irreducibility and its consistence. Digital pressure may cause it to disappear in the umbilical fossa, but it disappears by depressing the floor of the fossa. It reappears in in its entirety by the resiliency of the walls of the fossa as soon as the pressure is removed. It has the soft consistence of fungous tissue, so that it is depressed and flattened and its shape changed even by slight pressure. It arises in most instances from the inferior part or floor of the umbilical fossa, and it contrasts in appearance with the cutaneous folds of the umbilicus by its softness and reddish tinge.

This tumor does not exhibit any tendency to ulceration nor to hemorrhage in the proper sense of the term, but a sanguinolent serum exudes from it and stains the linen unless the growth be small. The thin irritating discharge from the surface or base of the vegetation sometimes causes small excoriations upon the edge of the fossa. In a child of one year and a half, whose case is detailed by Foster, the ulceration from this cause attained considerable size. It is said that cases have been observed in which the redness increased when the infant cried, and other cases in which the vascularity was such that more or less hemorrhage occurred when the tumor was injured. In these last cases umbilical nævi may have been mistaken for vegetations.

Progress.—This vegetation in the first days or weeks increases more rapidly than subsequently. It may attain half the size or the full size of a pea, or even a greater development, by successive sprouting of granulations. It may increase slowly during many weeks or months, or it may come to a standstill and show no tendency to diminish or atrophy. In time, according to several writers, it is likely to shrivel and skin grow over it, and thus be cured. But more frequently surgical interference is required.

Etiology.—It is reasonable to suppose that some excoriation of the surface precedes the granulations, and affords the base on which they arise; but why one child has this outgrowth, while another child, with the same management of the cord and apparently the same condition of the umbilicus, is free from it, does not perhaps admit of explanation.

Diagnosis.—This is readily made. The small size, irreducibility, reddish hue, the serous oozing, which stains the linen yellow, the softness, like exhuberant granulations in other localities, and the shape, enable the physician to diagnosticate this growth from any other kind of acquired tumor. An umbilical nævus has greater firmness and a deeper red color, which disappears on pressure and becomes more pronounced when the infant cries. The nævus is also less elevated, and it extends laterally and vertically farther than the vegetation, often passing beyond the umbilicus. From other tumors occurring at the umbilicus, as adenoma and sebaceous and other cysts, the diagnosis is easily made, since tumors other than the vegetations and nævus are covered with skin, are not attended by the serous oozing which stains linen, and most of them are congenital.

Histology.—M. Albarran and others have made microscopic examination of these vegetations, and found that they consisted of frail, feebly-organized connective tissue, round cells with large nuclei, capillaries with walls consisting of swollen endothelial cells, and vessels of larger size with narrow lumina and with walls formed by concentric layers of flattened fusiform cells. In another case examined microscopically fasciculi crossed each other, forming alveoli which contained cellular elements that were abundant in proportion to the fibrillar stroma. The vegetations always contain numerous small blood-vessels, true embryonic capillaries, with walls consisting of young cells arranged concentrically. They are made up of these small vessels, frail connective-tissue cells, and some granular intercellular substance.

Treatment.—Cauterization by nitrate of silver acts slowly, but sometimes destroys the vegetation if small. More efficacious and preferable treatment is to remove the growth by the scissors or ligature. Saint-Germain operates as follows: The fold of the skin surrounding the umbilicus is depressed, while slight traction is made on the excrescence by the forceps. The pedicle is then strongly tied by a silk thread perviously dipped in a solution of carbolic acid. Slight traction then suffices to remove the growth, and they sometimes drop off in the tying. After the removal a little iodoform should be dusted into the umbilical fossa, and the umbilicus covered by a pledget of surgeon's lint retained in place by strips of adhesive plaster.

UMBILICAL HEMORRHAGE.

Hemorrhage occurring at birth or soon after from too loose ligation of the cord, or from its laceration, is so well known and its cause so apparent that it need only be alluded to in this connection. Bouchut relates a case in which death took place from this cause even before birth. The child was attached to the placenta by a navel-string so short that it prevented delivery till it parted by the traction of the forceps. The bleeding from the umbilical vessels was so profuse that the child was pallid and lifeless when born.

But another form of umbilical hemorrhage sometimes occurs in the newly-born. The oozing takes place from the umbilicus itself, and not from the loosely-tied or torn umbilical cord. One of the first cases on record of this hemorrhage was published in the *Gentleman's Gazette*, in April, 1752, by Mr. Watts of Kent, England; but after the publication of this case a century elapsed before umbilical hemorrhage attracted the attention which it merited. In April, 1852, Dr. Francis Minot read a paper on this disease, containing the statistics of 46 cases, before the Boston Society for Medical Improvement. Three years subsequently, in 1855, Dr. Stephen Smith of New York read a monograph on the same subject, containing the statistics of 79 cases, before the New York Statistical Society. This was followed in 1858 by a statistical paper from the pen of Dr. J. Foster Jenkins, read before the United States Medical Association and published in its *Transactions* for that year. This monograph was elaborate, since the writer succeeded in obtaining the histories of 178 cases from medical journals and members of the Association.

Sex; Age.—In the cases collated by Jenkins, 34¼ per cent. were females and 65¾ per cent. males. However, it seems improbable that sex produces any difference in the liability to umbilical hemorrhage. The following table gives the ages at which the hemorrhage began in 99 cases:

Age.	No.	Age.	No.
On the 1st day	5	8th to 10th day, inclusive	25
" " 2d "	7	11th to 15th " "	16
" " 3d "	6	16th to 21st " "	4
" " 4th "	3	22d to 56th " "	1
5th to 7th day, inclusive	32		99

These statistics are interesting as showing the relation of the hemorrhage to the umbilical cord. In the 18 cases in which the hemorrhage occurred under the age of three days it may be assumed that the cord was attached, and the blood escaped from the walls of the umbilical fossa outside of the line of its attachment. Immediately after the fifth day, or after the time when the cord falls, there was a large increase in the number of cases, so that from the fifth to the fifteenth day after birth was the period of greatest liability to the hemorrhage. Since, as many observations have shown, in a large proportion of cases the blood has feeble coagulability, it seems probable that the umbilical vein and the umbilical and hypogastric arteries may not have been occluded by fibrinous coagula in at least some of these patients, as they commonly are in the healthy, and that the hemorrhage occurred in part from these vessels. This hypothesis is rendered more plausible by the fact that from the general ill-health present in many of these infants, probably the walls of the vein and arteries were lacking in contractility, so that they remained more patulous than in robust and healthy infants.

Causes.—Hemorrhage from the umbilicus, so well as from other parts in the newly-born, must be referred to a faulty composition of the blood, especially its feeble coagulability, or to an abnormal state of the walls of the minute vessels, or to both these causes. The hemorrhage is sometimes referable to the hemorrhagic diathesis or hæmophilia, which may be inherited or may result from obscure causes in children born of healthy parents. In the New York Infant Asylum a well-developed and apparently healthy mulatto woman gave birth to her first infant on Nov. 30, 1886. She stated that her family were healthy and that the father of the child was also in excellent health. The birth was easy and natural, and nothing unusual was observed in the infant, which weighed nearly ten pounds, except a swelling from extravasated blood above and in front of the right ear. At 7 A. M. on the next day severe umbilical hemorrhage occurred, which was checked by styptics; then slight epistaxis took place. At 11 A. M. bleeding from the navel returned, and appeared to come from several points at the margin of separation of the floor of the umbilicus from the cord. The tumor above the ear increased, purpuric spots appeared upon the integument, and death occurred from exhaustion on December 2d. The infant lost one pound in weight during the two days of its existence. At the autopsy a few small superficial erosions could be made out in the umbilical fossa at the point of union with the cord. The umbilical vein, traced to the liver, and the hypogastric arteries, traced to the iliac arteries, contained no blood, were patulous, and apparently normal. Extravasations of blood were found under the skin, in the abdominal cavity, and at numerous points in the lungs, etc. The organs had an exsanguine appearance, and everywhere the blood was without clots. Its fluidity is to be noted. The cause of the hæmophilia in this child is not apparent. Its parents, so far as could be ascertained, were healthy; still, it may have belonged to a family of bleeders, for the hemorrhagic diathesis sometimes passes over one generation and reappears in its children.

Syphilis is one of the recognized causes of the hemorrhagic diathesis in the newly-born. In 1871, I was requested to visit a neonatus who was a bleeder, whose father had syphilis in an unmistakable form, and whose mother was suspected to have contracted the same from her husband. The child was fairly developed, and the cord separated on the sixth day. A constant oozing of blood from the navel commenced on the seventh day, on account of which I was summoned to the case. I finally succeeded in arresting the bleeding by the application of the plaster-of-Paris dressing, but immediately intestinal hemorrhage commenced, of which the child died in twenty-four hours. The parents were induced to take antisyphilitic remedies for a considerable time, and they have since had four healthy children. In another instance observed by me, an infant, puny and apparently premature, was at birth observed to have several blebs of pemphigus, from which blood soon began to ooze, but the umbilical hemorrhage from which the child died did not begin until about the fourteenth day.

Two elements or factors appear to be present in producing hemorrhagic syphilis in the newly-born. We have already alluded to abnormal fluidity of the blood, for when it escapes it does not coagulate or its coagulation is very inadequate. The other factor is abnormalities in the minute vessels. Many years ago the eminent obstetrician Sir James Y. Simpson of Edinburgh met cases of hemorrhage in the newly-born which he attributed to inflammation of the vessels, arterial or venous, or both, from which the blood escaped. The inflammation, in his opinion, caused thickening and infiltration in the walls of the vessels, loss of tonicity, and consequently a patulous state. Simpson does not seem to refer in particular to the hemorrhage due to syphilis, but to that from other causes as well. Dr. Mracek, lecturer on syphilis in the University of Vienna, reported 19 cases of hemorrhagic syphilis in neonati.[1] None of the mothers had undergone antisyphilitic treatment. One of the infants was born dead, while the others lived from half an hour to forty-eight hours. The capillaries, the vasa vasorum, the venules, and arterioles were filled with morbid products, having caused local troubles of circulation and sanguineous effusions.

Among the first to draw attention to hemorrhagic syphilis of the newly-born was Behrends in 1883, whose opinions were based on clinical observations. His views received support and confirmation from cases observed by Kassowitz, Dreahma, and Emilio Schutz. The last physician made careful microscopic examination of the vessels in infants who died of this hemorrhage. Andronico also published an interesting paper on hemorrhagic syphilis of the newly-born.[2] His observations justify, in his opinion, the statement that hemorrhages in syphilitic neonati are due not only to "diminished power of coagulation of the blood," but to a "vascular ectasis, particularly in the small cutaneous veins."

Widerhofer,[3] remarking on hemorrhage in the syphilitic infant, attributes it to the blood dyscrasia.

Bleeding from the navel also sometimes occurs as a symptom or complication of jaundice. Writers who have collected records of this hemorrhage have remarked the frequent occurrence of the icteric hue both before and during the bleeding, even in those who do not present the history of syphilis. It is not improbable that in certain instances the jaundice is hæmatogenous, arising from destruction of the red globules and liberation of the hæmatin—a not unusual result of a profound dyscrasia even when there is no syphilitic taint. In other instances the jaundice proceeds from the liver, and the bleeding occurs from the altered state of the blood, which is produced by abnormalities in the liver or its appendages. Thus in at least five of the cases of umbilical hemorrhage collated by Jenkins the marked jaundice which was present was found to be due to congenital occlusion of the common bile-duct, and of course all the bile secreted which did not remain in the liver entered the blood. The biliary acids in the blood probably diminish the amount of its fibrin and increase its fluidity.

Poor health in the mother and impoverishment of her blood during gestation, whether from chronic disease, as tuberculosis, or antihygienic conditions, also cause impoverishment, and increase the fluidity of the blood, and therefore act to a certain extent as a predisposing, if not as a direct, cause of the hemorrhage. Some have supposed that the excessive use of diluent drinks or alkalies by the mother during gestation also increases the fluidity of the blood of the fœtus and renders it more liable to hemorrhages after its birth.

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[1] *Berlin. klin. Woch.*, No. 46, p. 807, Nov. 15, 1886.

[2] *Arch. di Pat. Infan.*, July, 1886.

[3] *Allgem. Wien. Med. Zeitung*, No. 4, 1883.

In exceptional instances no adequate cause of the bleeding can be detected either in the child or the health of its parents. Thus in the *Archives of Pediatrics* for May, 1884, Dr. Seibert relates the case of an infant whose umbilical dressing and clothing were saturated with blood at the twentieth hour after birth. The bleeding was arrested, but it returned, and the child died. No coagula of blood occurred either in the pools or the saturated clothing. There was no history of hæmophilia or syphilis in the parentage or lineage, and the child at birth was plump and apparently healthy, having no petechiæ, pemphigus, jaundice, or ecchymoses. The health of the mother had not, however, been good during gestation.

Ordinarily, umbilical hemorrhage occurs without premonition, but occasionally it is preceded by jaundice. Jaundice was a prodromal symptom in 41 of the 178 cases embraced in Jenkins' statistics, and, besides the icteric hue, constipation, clay-colored stools, deeply-tinged urine, etc. were recorded in some of the cases. Rarely colicky pains and vomiting precede the hemorrhage. The blood oozes slowly or rapidly. It seldom escapes in a jet, even when its color shows that its source is more arterial than venous.

Grandidier collated the histories of 202 cases, and the examination of these enables him to make the following statement: The hemorrhage often begins at night, so that it may continue a considerable time before it is detected. He also states that vomiting, colicky pains, somnolence, and especially icterus, with constipation or clay-colored stools, sometimes occur. In 135 of the cases embraced in Grandidier's statistics the hemorrhage occurred in 38 before the fall of the cord, in 26 at the time of its separation, and in 71 at a later date.

Prognosis.—This is unfavorable. Statistics show that 5 in every 6 perish. The prognosis is most unfavorable when an obvious dyscrasia is present. Those who have jaundice or hæmophilia with very few exceptions survive. Those are most likely to recover who have a healthy parentage, no obvious dyscrasia, and in whom the hemorrhage occurs late and is not profuse. The average duration of the hemorrhage in 82 cases in Jenkins' collection was three and a half days, the minimum being only three hours. Death usually occurs from exhaustion.

Treatment.—A compress of surgeon's lint or a sponge saturated with the liquor ferri subsulphatis should be firmly pressed over the umbilicus and retained by a bandage. If the bleeding do not cease, the umbilicus should be covered by a thick layer of plaster of Paris, supported by the hand until it hardens, and then retained in place by the bandage passing around the body. In the case related above, occurring in my own practice, this treatment arrested the bleeding from the navel, but it was followed by fatal intestinal hemorrhage. If the hemorrhage continue, the needles with ligature may be employed. Bouchut indeed states that this is the only effectual treatment. Two needles are passed through the umbilicus at right angles, and a waxed thread wound around each in the form of the figure 8. If the patient survive, the needles should be removed in four or five days and iodoform or a poultice applied. It is important, so far as time will permit, to treat the dyscrasia, and a laxative is often indicated, especially if constipation be present. A laxative is useful for its effect on the hepatic circulation and as a derivative. Both Smith and Jenkins recommend calomel for this purpose. During the continuance of the hemorrhage four or five drops of brandy in breast milk frequently administered are useful as a stimulant.

SEPSIS OF THE NEWBORN.[1]

The manner in which sepsis or septicæmia occurs is sometimes obscure. Leube in 1878 relates two cases[2] in which the examination failed to disclose the source or mode of infection. He designates such cases cryptogenetic, expressive of the unknown or occult origin. Wunderlich and Schützenberger allude to similar cases. But in sepsis of the newly-born it is the common and apparently correct belief that the poison of sepsis usually enters the system at the umbilicus. The cases which I am about to relate are in harmony with this theory.

It is not my intention to discuss the nature of the septic poison, but there can be little doubt, from the examinations which were made, that in the following cases it consisted of microbes and the ptomaïnes or chemical agents produced by microbic action.

Cases of sepsis of the newly-born may be conveniently classified as follows:

FIRST GROUP.—*Cases of umbilical phlegmon, which is a local sepsis, the poison entering the system from an umbilical sore, and being conveyed by the lymphatics.*

The New York Infant Asylum at Sixty-first street and Tenth avenue has, during the twenty-three years of its existence, been remarkably free from contagious and infectious disease, but since September 1, 1887, seven cases, in which either local or systemic sepsis was diagnosticated, occurred in newborn infants in the maternity ward of this institution.

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[1] Read before the Pædiatric Section of the New York Academy of Medicine, *Medical News*, Sept. 8, 1888.

[2] *Deutsch. Archiv für klin. Med.*

It is proper to state that at the same time diphtheria was epidemic in the asylum, and that five of the newly-born infants had diphtheria, the pseudo-membrane appearing in its usual situation on the pharyngeal, nasal, and laryngo-tracheal surfaces, and, in one or two of the patients, also lining the œsophagus. Moreover, two of the five infants with diphtheria had umbilical phlegmon of a few days' duration when the diphtheritic exudate appeared upon the faucial surface.

The question is therefore a proper one, whether in these two cases the phlegmons were a local manifestation of diphtheria, or whether the umbilical phlegmon and diphtheria were distinct diseases having a different microbic origin.

Case I.—Victor M—— was born, after normal labor, on January 5, 1888, and the umbilicus was dressed with borated cotton. The mother did well, and was able to leave her bed on the seventh or eighth day. Nothing unusual was noticed in the infant until January 11th, when a little suppuration was observed in the umbilical fossa at or around the point of attachment of the cord, and on examination the walls of the umbilicus were found thickened and indurated. The appearance indicated the commencement of an umbilical phlegmon, and the skin covering it was red as in erysipelas. The phlegmon extended in area until January 14th, when the thickening and infiltration reached to the distance of about one and a half inches in every direction from the umbilicus, so that the form of the phlegmon was circular or wheel-shape. Its thickness or depth near the umbilicus was perhaps three-fourths of an inch, but near its margin the thickening and infiltration were less. The pulse on the 13th varied from 132 to 144, and the rectal temperature was 101.8°.

The case was carefully watched by Drs. Davis and Cook, the resident physicians, whose records I employ, and the faucial surface was daily inspected by them. On January 14th, the baby being nine days old, they observed for the first time the grayish-white exudate of diphtheria on each side of the fauces, and a day or two later also upon the Schneiderian surface, so closing the nostrils that respiration through them was impossible. The baby, on attempting to draw the nipple, became cyanotic and was obliged to relinquish its hold. During the 14th and 15th the temperature fell to 98.5° and 98°, the pulse was very feeble and too rapid to be counted accurately, and the respiration varied from 24 to 48. Death occurred on the 15th at the age of ten days.

The autopsy revealed a diphtheritic pseudo-membrane upon the faucial surface on both sides, extending downward, so as to cover both surfaces of the epiglottis, the entrance of the larynx, and the laryngeal surface, completely concealing the vocal cords and the portion of the larynx above them. The trachea and bronchial tubes were free from the exudate. The lungs in nearly every part were thickly mottled with points of extravasated blood, and less abundant extravasations were observed in and upon other organs. The umbilical phlegmon, removed entire, and in a frozen state from the intensity of the cold in the deadhouse, was sent to the laboratory of the College of Physicians and Surgeons, where it was carefully examined by Dr. Prudden. He reports that the umbilical vessels were in their normal state, showing no evidence of disease, except the mouth of the umbilical vein or that portion of the vein which was next to and in immediate relation with the umbilicus. Plugging the mouth of the vein and extending a few lines along the lumen of this vessel was a thrombus or blood-clot, from which Dr. Prudden was able to obtain cultures, and in the culture-bed two forms of cocci were developed—to wit, the Staphylococcus pyogenes aureus, occurring in the usual form in groups, and the Streptococcus pyogenes, producing beautiful and delicate chains. The portion of the vein enclosing the thrombus or clot had preserved its integrity, so that the clot was entirely distinct from the phlegmon which covered the vein. It did not seem possible that microbes, ptomaïnes, or elements of the blood could pass from one to the other, on account of the firm coats of the vein which were interposed between them.

Portions of the phlegmon placed in culture media developed the same forms of cocci as those produced from the clot that plugged the mouth of the vein. We infer that the cocci were the septic agents, since no other cause of the sepsis was discovered, and that they were received from the umbilical sore. Some entered the thrombus, and others, taken up by lymphatics, entered the tissues which surrounded the umbilicus and gave rise to the phlegmonous inflammation.

It is easy to understand how micro-organisms may enter the umbilical vein after the fall of the cord, when there may not be complete closure of the mouth of the vessel. But it can scarcely be doubted that in the above case, as well as in cases which I am about to relate, the septic infection took place through the raw and denuded surface of the umbilical fossa, the lymphatics being the carriers of the poison. We know how frequently granulations sprout out from the umbilicus of the newborn, and wherever there is a surface denuded of cuticle from which these may arise there is a surface from which microbes or toxic agents may be absorbed. The umbilicus, too, is a receptacle in which microbes, conveyed in the floating dust of an apartment, in foul water used for bathing, in dirty sponges, or abdominal binders or umbilical dressings, would be likely to lodge. M. Bouchut, in his remarks on the fall of the umbilical cord, says, "Cords voluminous, soft and plump, dry slowly and often suppurate at their base before they fall (les cordons volumineux, mous et gras, se dessèchent lentement et suppurent souvent à leur base avant de tomber)."[1] With conditions so favorable for septic infection it is perhaps surprising that it does not more frequently occur, especially in hospital or asylum wards.

The patient whose case I have related evidently had systemic infection in addition to the local septic infection in the phlegmon. The numerous points of extravasated blood in the lungs and elsewhere showed this. But doubt must arise whether this general infection occurred from the phlegmon, in which there was intense hyperæmia and an active circulation, as shown by the inflammatory redness of the cuticle, or whether it resulted from and was connected with the diphtheria. But we will relate cases of systemic infection in which there was no diphtheria and in which the septic agent or agents entered the system through the umbilicus.

The volume of the *Transactions of the London Pathological Society for 1879* contains an able and elaborate report of the committee appointed by that society to investigate pyæmia, septicæmia, and purulent infection. Their report is based on the examination of the records of 156 cases occurring in the London hospitals, and it throws light on the cause of hemorrhagic extravasations occurring in cases ôf septic infection of the system. They remark: "On microscopical examination of different organs, micrococci were found in all, or at least in some, of the viscera. They were nearly all in the blood-vessels, completely plugging capillaries; in masses which sometimes produced varicosities, or even rupture of the vessels, and extended into the contiguous tissues."[2]

CASE II.—Hilda M——, born February 28, 1888, was plump and robust, weighing eight pounds and seven ounces. The mother appeared to be well until March 3d, when she had fever and symptoms which were apparently due to pelvic cellulitis, probably of septic origin. The infant was fretful on March 3d and 4th, and on March 5th a small ulcer was observed in the umbilical fossa. The skin surrounding the umbilicus, over an area the size of a silver dollar, had a deep-red color, and the tissues underneath, constituting the abdominal walls, were infiltrated and thickened. The phlegmon gradually extended in every direction from the umblicus, so that on March 6th it nearly reached the ensiform cartilage above and the pelvis below. The fauces had been inspected daily, and at 5 P. M., March 6th, the grayish-white exudate of diphtheria was observed for the first time, covering the tonsillar portion of the fauces on each side. On March 7th the exudate had increased, the cry was hoarse, the fingers livid at times, and fluid regurgitated through the nostrils. The phlegmon occupied nearly the entire abdominal walls anteriorly. March 8th, surface cyanotic; respiration labored, and at times accompanied by the expiratory moan; a diphtheritic pseudo-membrane in the right nostril. Death occurred at 6.30 A. M., March 9th, at the age of ten days, on the fourth or fifth day of the phlegmon and on the third day of the diphtheritic exudate upon the fauces. The rectal temperature varied from 99.8° to 102.8°, until the last day, when it was subnormal, being 96.6° ; the pulse varied from 90 to 112, and the respiration from 40 to 60. Both the pulse and respiration gradually increased in frequency until death, this increase being probably largely due to the double pneumonia. The tincture of the chloride of iron in glycerin, brandy, and breast-milk were given internally, iodoform and carbolized oil applied to the umbilicus, and antiseptic sprays employed to the fauces and nostrils.

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[1] *Traité pratique des Maladies des Nouveau-nes*, etc.

[2] *Brit. Med. Journ.*, January 24, 1880.

Prof. T. M. Prudden kindly consented to conduct the autopsy, which was made with sterilized instruments and under conditions designed to prevent access to the body of adventitious germs. The following are his notes :

Autopsy.—The umbilical orifice was covered by a dry, brownish scab, beneath which was a small, rough-edged cavity containing a yellowish semi-solid mass. The abdominal wall, for about three centimeters around the umbilicus on all sides, was hard, thickened, and dusky red. A section through the abdominal wall in the line of the umbilicus showed that the wall was thickened to about 1.5 centimeters immediately around the latter.

Both the umbilical vein and the hypogastric arteries, to the distance of about 1.3 centimeters from their attachment to the abdominal wall, were much thickened, red and hard, and their inner layers were converted into a soft, yellowish, friable material. Beyond this point all of these vessels were filled with blood-clots and appeared healthy. There was no peritonitis, and all of the abdominal organs were normal.

The heart was normal. The pharynx, larynx, and trachea showed soft, reddish, friable patches of diphtheritic membrane partially covering their free surfaces. This membrane did not extend into the bronchi. The lungs exhibited broncho-pneumonia in both lower lobes, with considerable consolidation.

The microscopical examination of the parts about the umbilicus showed that at the point of attachment of the cord was a small pus-cavity whose walls were infiltrated with small spheroidal cells, with a few rod-like bacteria and with large numbers of spheroidal bacteria. Similar spheroidal bacteria were found in the purulent detritus contained in the cavity as well as within the lumina, and infiltrating the walls of the adjacent ends of the umbilical vein and the hypogastric arteries.

The tissues of the abdominal walls about the umbilicus were infiltrated with serum, fibrin, and a moderate amount of pus. Spheroidal bacteria were rather scantily scattered in the lymph-spaces of the swollen tissues, being most abundant near the umbilical vessels.

Biological examination of the contents of the inflamed portion of the umbilical vessel showed the presence of several species of bacteria. The species which was by far the most abundant was readily identified as the Staphylococcus pyogenes aureus.

The anatomical diagnosis, then, is diphtheria of the pharynx, larynx, and trachea, with double broncho-pneumonia, localized septic inflammation of the umbilical vein and hypogastric arteries and of the abdominal wall surrounding them.

As the evidence of local infection is so great, it seemed desirable to gain some data as to the purity of the air in the wards. Accordingly, such analyses as time permitted were made by Dr. T. M. Cheeseman, Jr., who presented the following: "A biological examination of the air in the lying-in ward of the New York Infant Asylum, made on March 7, 1888, showed a very large number of living bacteria of many different kinds. Among them the Staphylococcus pyogenes aureus was of frequent occurrence. A second examination, made immediately after the usual sulphur disinfection, showed a large number of living germs."

CASE III.—Janse J——, born January 3, 1888, was wet-nursed by its mother, and apparently did well until January 16th, when the attention of the resident physician was directed to it, and an umbilical phlegmon was discovered as large as a twenty-five cent piece, the skin covering it being intensely red; temperature 98.5°. The dressing, after the discovery of the phlegmon, consisted in dusting with iodoform and the application of carbolized oil (one part of carbolic acid to twenty-five of sweet oil). January 17th, phlegmon not extending and its surface less red. The redness, thickening, and infiltration gradually abated, and on January 21st the patient was removed from quarantine. In this case there was no record of an umbilical sore; the fauces remained normal, so that the diagnosis of diphtheria was excluded. The mother continued well.

CASE IV.—George C—— was born in the maternity ward January 14th. On January 25th the nurse observed a small vesicle upon the border of the umbilicus, and removed the cuticle covering it. Some hours afterward the attention of the resident physician, Dr. Davis, was called to it, who found thickening and infiltration of the umbilical wall, most marked on the side which had been occupied by the vesicle. The same treatment was employed as in Case III. The records of January 26th and 27th state that the redness and infiltration are abating, and on the 29th the umbilicus had returned to the normal state.

CASE V.—John S——, born October 14, 1887, the mother being a healthy primipara. The child was well developed at birth, weighing nine pounds and four ounces. The cord fell on the sixth day, and a small ulcer with indurated edges was observed in the umbilical fossa at the point of attachment of the cord. The induration in and around the umbilicus increased slowly until the ninth day. On the ninth day the child was restless, and on examination the ulcer was found enlarged and surrounded by a zone of inflamed tissue half an inch in width. The inflammation, accompanied by the usual infiltration and swelling, gradually extended, so that on the 15th the diameter of the inflamed area was two inches. The ulcer had also increased. On the twentieth day after birth the ulcer had attained the diameter of two inches and the depth of three-eighths of an inch, but the induration had begun to abate. From this time improvement was progressive, and no notes were taken after the twenty-fourth day. The rectal temperature, ascertained each day from the ninth to the twenty-fourth day, varied from the normal to 102°. During the active period of the phlegmon it was usually from 100° to 101.5°, and the emaciation was progressive, the loss of weight being estimated at two pounds. The treatment consisted in dusting with iodoform and the use of a compress of absorbent cotton soaked with a solution of carbolic acid. During the second week, under the advice of the attending physician, Dr. George B. Fowler, calomel was also dusted on the sore. On the twenty-fourth day the infant was removed to the Post-Graduate School, and its subsequent history is unknown. The mother had no unfavorable symptom.

CASE VI.—Joseph D——, born October 22, 1887, well developed, weighing seven pounds thirteen ounces. The cord fell on the eighth day, leaving a small ulcer at its point of attachment with an indurated border. Two days later, the tenth day after birth, the ulcer had increased slightly, being one-quarter of an inch in diameter. The surrounding tissues to the distance of one inch were thickened and indurated from inflammation. At no time was the temperature above 99.1°, and the child, though restless, nursed well. The tumefaction and hardness surrounding the umbilicus remained about the same until the sixteenth day, after which they gradually abated. The ulcer had healed at the end of the fourth week. The mother on the third day after confinement had elevation of temperature which continued four days; and six weeks after the birth of the child she had diphtheria in the usual form. During the same month—October—twenty-seven obstetrical cases were under observation, but all except this patient convalesced without an unfavorable symptom.

SECOND GROUP.—*Cases in which the septic poison probably entered the system through the umbilical vein.*

CASE I.—In May, 1884, an infant died of sepsis at the New York Infant Asylum at the age of fifteen days. It was apparently well until about the close of the first week, when the umbilicus was observed to be raw, and a slight oozing of a puriform liquid occurred from it. During the second week the abdomen was hard and tender, and peritonitis was diagnosticated. The cord fell on the seventh day. During the second week the abdomen was apparently painful; the temperature three days before death was 100.6°, and two days before death 102.4°. Examination of the chest gave a negative result. The post-mortem examination was made by Dr. W. H. Welch, now professor of pathology in Johns Hopkins University. The abdomen contained six ounces of turbid serum with flakes of fibrin. The portion of the peritoneum covering the umbilical vein and along the under surface of the liver, especially at the transverse fissure, was covered with fibrin, but the peritoneum generally did not exhibit any notable hyperæmic or inflammatory appearance. Lymphatic vessels filled with purulent-appearing substance could be seen in the under surface of the diaphragm, showing in what way septic infection extends along the lymphatics. The lymphatics of the diaphragm open upon the pleural surface, and it is probable had the patient lived longer that septic pleuritis, perhaps on both sides, would have occurred. The umbilical vein was filled from the umbilicus to the transverse fissure of the liver with a grayish softened detritus consisting of broken-down thrombi with a considerable proportion of pus. Softened thrombi could be traced the entire length of the umbilical vein, the walls of which were thickened and infiltrated from inflammation. No thrombi were seen in the portal vein or vena cava; the pericardium contained more than the normal amount of serum with flakes of fibrin; hemorrhagic points were observed in the posterior portions of the lungs under the endocardial surface, under the peritoneal coverings of the kidneys and mucous covering of their calices. The mother did well, giving no evidence of disease of any kind.

CASE II.—This infant, born in the New York Infant Asylum, the date not being given, was well developed at birth, weighing eight pounds six ounces. When four or five days old it became feverish, the temperature rising to 104.6°. The cord separated at the usual time, and the umbilicus seemed healthy. At the age of two weeks an abscess appeared upon the scalp, another upon the back, and another upon the nates, which raised the suspicion of septic poisoning. At the age of four weeks orchitis on one side occurred, which continued three weeks, when it abated. When the child was two months old a prominence appeared about half an inch above the umbilicus, which Dr. Parker, the resident physician, punctured, and bile flowed from the incision. Subsequently the incision closed, and bile flowed from the umbilicus, and continued to flow until death, which occurred, in a state of much emaciation and weakness. at the age of eight months.

At the autopsy, made by Prof. Welch, remains of old abscesses were found upon the trunk and extremities, and an abscess holding four drachms of pus was found over the occipital bone. Underneath the abscess the bone was carious and the dura mater thickened. The umbilical vein was much larger than normal, its walls being infiltrated and thickened, and its lumen of about twice its usual diameter. It contained thickened bile. One of the branches of the vein, traced into the liver, opened into an abscess the size of a walnut, which contained thickened pus with bile. The abscess was in the right lobe near its posterior border. The mother remained well.

CASE III.—Lizzie C——, born September 21, 1887, robust, weighing eight pounds, seemed well, taking the breast and having normal evacuations, until September 28th, when she became restless and refused the breast. Her temperature, rectal, was 101.4°, and her respiration was accelerated and accompanied by the expiratory moan. September 20th, temperature 103.6°; respiration accelerated and painful and abdomen distended; no cough. The diagnosis of peritonitis, probably of septic origin, was made, but the umbilicus was of usual appearance, and the desiccation and fall of the cord seemed normal. The elevation of temperature, even to 104.4°, the distension of abdomen, and the hurried respiration with expiratory moan continued until death, which occurred September 30th.

At the autopsy three ounces of sero-purulent liquid containing flakes of fibrin escaped from the peritoneal cavity. All the abdominal organs were covered by a fibrinous exudation, the intestines being matted together by it. The umbilical vein was pervious; it contained clots of blood and dirty-looking pus, but the umbilicus was apparently normal. A segment of the aortic valve was thickened and rigid, and attached to it was a fibrinous mass. The appearance indicated an endocarditis of slight extent. Under the microscope the walls of the umbilical vein presented their normal appearance, but its dirty-looking and disintegrating contents probably contained septic matter. The hepatic cells exhibited the peculiar cloudiness observed in protracted febrile diseases. Otherwise the organs seemed healthy. In this case also the mother remained well.

CASE IV.—A. B.——, born January 22, 1868; father healthy, but mother strumous, though in good health during her gestation. The infant, born after an easy labor, was apparently well at birth, and it had sufficient breast-milk. When it was thirteen days old I was requested to visit it, as it had not been doing well, and I found it suffering from subcutaneous abscesses. Abscesses had occurred upon both legs, in the chest-walls of the right mammary region, in and around the metatarso-phalangeal articulations of one foot, and over both knee-joints. The child had fever, but its respiration was good until February 8th, when it suddenly had a severe attack of dyspnœa, which continued until death, ten hours subsequently. On the following day Dr. Charles A. Leale and myself made the autopsy. The body was moderately emaciated. About one ounce of pus escaped from the right knee-joint. Pus was also found in the joint of the great toe on one side, and about two ounces in an abscess under the right pectoral muscle. A thin layer of tissue constituted the internal wall of the abscess, so that had life been prolonged a few days it would probably have broken through into the pleural cavity. The right lung was completely collapsed, and the pleura lining this lung, as well as that lining the thoracic walls on the same side, was covered by a fibrinous exudation. The left lung contained the normal, or perhaps more than normal, amount of air, so that it filled the pleural cavity, but there was a small amount of fibrinous exudate upon the parietal pleura in this cavity.

The trachea and lungs attached were removed, and on practising insufflation of these organs, air escaped from three openings in the posterior part of the right lung. These openings through which air had passed into the pleural cavity, causing collapse of the entire lung, were found on examination to have been produced by small abscesses in the tissue of the lung near its posterior surface. By the rupture of these abscesses the pus which they contained escaped into the pleural cavity, producing intense general pleuritis and pneumothorax. Numerous minute abscesses were found in both lungs, but only the three alluded to had been ruptured. It seemed certain that had the patient lived longer other abscesses would have ruptured.

CASE V.—In the following case bacteria were found making their way along the umbilical vein at a distance from the umbilicus, and also in the tissues involved in the umbilical phlegmon. Those in the phlegmon were apparently derived from the umbilicus and conveyed by the lymphatics. This case, therefore, might be placed in the first group as well as the second:

Anne —— was born in the New York Foundling Asylum on May 18, 1888. A few days after birth, and before the cord dropped, the umbilicus was observed to be foul from secretion or exudation in it, indicating a sore at the base of the fossa. On the seventh day an umbilical phlegmon was noticed small and confined to the umbilical walls. Three white patches were also observed on the roof of the palate near the velum, not raised and apparently not diphtheritic, resembling superficial ulcers. All the infants born in the maternity ward of the Foundling Asylum receive Credé's treatment, designed to prevent purulent conjunctivitis, one drop of a 2 per cent. solution of nitrate of silver being instilled between the eyelids of each eye. Although this child was thus treated, she had a pretty active purulent conjunctivitis of the left eye, to which our attention was now called for the first time on the seventh day. Credé's treatment was immediately reapplied to this eye, one drop being introduced between the lids. This was followed by the corrosive-sublimate treatment recommended by the late Prof. Samuel D. Gross. A solution of the sublimate, two grains to the pint, was dropped between the lids every hour to two or three hours, four or five drops being used each time. The conjunctivitis rapidly abated, and in less than a week had nearly or quite disappeared. But the phlegmon presented a very angry appearance, and the umbilical walls were greatly swollen, red, and denuded of cuticle. The inflamed area had a diameter of about four inches, with the umbilicus at the centre. Iodoform and carbolized oil were applied to the umbilicus and iron and stimulants given internally. The rectal temperature, taken May 26th, was 98°. Death occurred May 27th.

Autopsy, by Dr. W. P. Northrup, curator, thirteen hours after death.—Body well nourished; no rigor mortis; no external lesion except the umbilical; the phlegmon definitely outlined and hard, its central half brown and dry; the infiltrated abdominal wall had twice its normal thickness; peritoneal surface of phlegmon congested and adherent to omentum; from this point to the transverse colon was a leash of dilated vessels, one inch in width and three or four inches in length; peritoneum injected and a few petechiæ observed in the parietal layer and the mesentery; mesentery deeply injected; liver and spleen normal; kidneys soft and flabby; points of hemorrhagic pneumonia in all the pulmonary lobes; abundant tenacious mucus covering the surface of the stomach and intense injection, showing acute gastritis; cerebral pia mater finely injected, but without exudation; brain normal. Diagnosis: umbilical phlegmon, peritonitis, acute gastritis, hemorrhagic pneumonia.

Microscopical and Biological Examination, by Prof. Prudden at the Laboratory of the College of Physicians and Surgeons.—The small ragged cavity at the umbilicus contained a moderate amount of pus, cell-detritus, and enormous numbers of bacteria of various forms, the spheroidal form predominating. The tissues of the abdominal wall about the umbilicus were infiltrated with fluid, fibrin, and pus; scattered about in this exudation-mass were small spheroidal bacteria. The hypogastric arteries and the umbilical vein were plugged with clots extending from one-half to three-quarters of an inch from their origin; their walls were greatly thickened by infiltration with inflammatory exudate. Both in the lumina of these vessels, along the sides of the clots, and in the lymph-spaces in their walls were enormous numbers of small spheroidal bacteria. These bacteria were present in the umbilical vein beyond the limits of the clots in the direction of the liver.

The kidneys showed moderate parenchymatous degeneration. The consolidated areas in the lungs were due to a nearly complete filling of the air-spaces and the smaller bronchi with blood.

Cultures made from the inflamed tissue about the umbilicus and from the edges of the sloughing cavity showed several species of bacteria common in the air and in the feces of children. In addition to these the Staphylococcus pyogenes aureus was present in large numbers. A set of cultures from the inside of the umbilical vein, at a little distance from the sloughing cavity, revealed the presence of Staphylococcus pyogenes aureus and Streptococcus pyogenes, together with other forms. Cultures from the liver showed large numbers of Staphylococcus pyogenes aureus, with considerable numbers of a stout bacillus similar to one abundant in the sloughing cavity. From the lung tissue from the consolidated regions enormous numbers of bacilli developed in a nearly pure culture, which corresponded in its biological characters to the Bacterium lactis aërogenes of Escherich.

Remarks.—This child would thus seem to have been the victim of infection with the ordinary "suppurative bacteria" and with feces. We infer that fecal matter in some way came in contact with the umbilicus.

THIRD GROUP.—*It seems probable that in exceptional instances the septic poison in sepsis of the newly-born is received in other ways or other channels than at the umbilicus.*

If sepsis of the newly-born occur through absorption from an umbilical sore, may it not also from a sore located elsewhere? Decomposing and disintegrating animal tissue, wherever located, may be the source of septic infection. Moreover, medical literature contains histories of epidemics of puerperal fever in which newly-born infants perished with what was often designated erysipelas, but which the modern pathologist would unquestionably designate sepsis. The disease which I have described as umbilical phlegmon, a local sepsis, was commonly regarded by the older writers as a form of erysipelas. Dr. Condie, in his *Treatise on Diseases of Children*, described in the following lines what we would now designate sepsis:

"Erysipelas of infants very commonly occurs during the prevalence of epidemic puerperal fever. Children of mothers who become affected with the fever are often born with erysipelatous inflammation; others are attacked almost immediately after birth. Whether in these cases the disease is to be referred to a morbid matter applied to the skin in the womb, or to the same endemic or epidemic influence which gives rise to the disease of the parent, it is difficult to say. According to M. Trousseau, infantile erysipelas is principally observed when puerperal fever prevails in the wards of the lying-in hospitals of Paris."

The late Dr. Folsom of this city furnished me the following sketch of cases which occurred in his practice and that of his partner: "About the year 1840, being then in practice in New Bedford, Mass., I was called to visit a man who complained of pain in the knee. The next morning he was easier, but the following evening his symptoms grew worse, and, as I was engaged in a case of obstetrics, my partner, Dr. E. C., now dead, visited him. At my call, next morning, I unexpectedly found the patient dying. The disease was obscure, and at the autopsy next day no lesion was discovered. In making the examination Dr. C. pricked his finger, and, experiencing little inconvenience from it at first, he attended a case of confinement on the following morning. A few hours subsequently he was taken sick, and I took charge of the lady, who died in three days, having the tumid abdomen and symptoms of childbed fever. The infant of the patient was seized, when two days old, with erysipelas, appearing on the face and in spots on the trunk and limbs, and terminating fatally in one day. Dr. C.'s finger became swollen and painful, and the lymphatics of the forearm and arm became inflamed, presenting red lines, and the axillary glands suppurated. Though feverish and much prostrated, there was no appearance of erysipelas in his case. In about two weeks he resumed practice, and, as at that time, physicians in this country were not fully aware of the danger of communicating puerperal fever, he attended two, three, or four obstetrical cases each week until the number reached fifteen. All the mothers died with symptoms of metro-peritonitis, and all the infants had erysipelas, commencing on the face or some part of the body, generally on the second or third day after birth, and in all terminating fatally within a week. This sad record was finally ended by the doctor's temporarily retiring from practice."

What better description could be given of a malignant form of septic infection? It will be observed that the unfortunate doctor did not have erysipelas, but inflammation of the lymphatics, occurring from the poisoned finger, and the infant who first contracted the disease and died of one day's sickness exhibited red spots upon the trunk and limbs of an erysipelatous appearance. Did the doctor poison the mothers and infants at the same time by his digital examinations? did he poison the mothers by his infected fingers, and they in turn poison the babies through the placental circulation? or did the infected mothers communicate the poison through the breath or milk? This is an interesting subject for inquiry in regard to which we are in the dark. Fortunately, the profession are now fully aware of the danger of septic infection, so that no intelligent and prudent accoucheur would attend an obstetrical case after making a post-mortem examination or visiting a case of puerperal fever without change of clothing and thorough personal disinfection, and consequently cases belonging to our third group are much more rare than formerly.

It is evident that sepsis of the newly-born might be prevented in a large proportion of instances by proper antiseptic dressing of the navel. Boric acid is a feeble and inefficient antiseptic, and the borated cotton which was employed in dressing the navel when the cases in the maternity ward occurred which have been related above was inadequate to prevent infection. Of the powders which might be prescribed for this purpose, salicylic acid or deodorized iodoform mixed with starch would appear to be much more efficient. Credé's method of preventing purulent conjunctivitis by instilling one drop of a 2 per cent. solution of nitrate of silver between the lids has been very effectual. Probably in a similar manner umbilical phlegmon might be prevented in maternity wards by bathing daily the umbilicus with a solution of the sublimate, grs. ij to the pint.

When an umbilical phlegmon has commenced we have employed dusting with iodoform, the application to the navel every two hours of carbolized sweet oil (1 to 30), and bathing the navel with a solution of corrosive sublimate, two grains to the pint of distilled or boiled water. In some of the cases thus treated when the phlegmons were small the patients gradually recovered, but in most of the cases the phlegmons were so large, and the microbes at such a distance from the umbilicus in the tissue of the abdominal wall, that antiseptics applied upon and around the umbilicus were not curative. Newly-born infants are probably too young and feeble to be satisfactorily treated by incisions in the phlegmon and the application of antiseptics to the incised surfaces, else this treatment might be more efficient than treatment without such incisions.

DIPHTHERIA OF THE NEWLY-BORN.[1]

Diphtheria of the newly-born is rare and the literature of it meagre. Nevertheless, a considerable number of cases under the age of one month has been reported. Oertel is mistaken when he writes: ". . . . In the first half year the infant organism seems to be not at all susceptible to the disease." Dr. Abram Jacobi writes in his *Treatise on Diphtheria:* "I have met 3 cases of diphtheria of the larynx and pharynx in the newly-born myself. One of these became sick on the ninth day after birth, and died on the thirteenth day; the other died on the sixteenth day after birth; the third was taken when seven days old, and died on the ninth day." Dr. Jacobi alludes to the thesis of Sirédey of Paris, published in 1877, in which 18 cases of diphtheria of the newly-born are related. They occurred during the spring of 1877 in the Hospital Lariboisière. He alludes also to several cases reported by Parrot, 1 of fifteen days by Bretonneau, 1 of seventeen days by Bednar, 1 of eight days by Bouchut, and 1 of seven days by Weikert.

Diphtheria, which had been prevailing in the New York Infant Asylum since October, 1877, appeared in the maternity wards of the institution in January, 1888. The patients affected with it were all newly-born infants, the mothers, although mostly young, escaping.

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[1] *Medical News*, Sept. 8, 1888.

CASE I.—Violet M——, whose case is related in the article on Sepsis. When she was six days old the phlegmon commenced; two days afterward nasal catarrh began, and a day later, when she was nine days old, the diphtheritic exudate was observed in her left nostril and upon the faucial surface. The symptoms in full are recorded in the article on Sepsis. Death occurred at the age of ten days. At the autopsy the pseudo-membrane was found on the surface of the fauces, both surfaces of the epiglottis, and the entire larynx to a point a little below the vocal cords. The vocal cords were completely concealed from view by the pseudo-membrane.

CASE II.—Olivia G——, born January 8th, was wet-nursed by her mother, and was apparently well until January 14th, when she became restless. On the following day, when she was seven days old, she was carefully examined and diphtheritic patches were observed upon the faucial surface. Rectal temperature 100°, respiration 36, pulse 120. She had commencing nasal catarrh, which so obstructed the breathing that she could not take the breast, and she was fed with the mother's milk from a spoon. Directions were given to syringe the nostrils at intervals of two hours with the following:

℞.	Ol. eucalypti,		ʒj;	
	Sodii bicarbonat.,			
	Sodii benzoat.,	*āā.*	ʒij;	
	Glycerinæ,		℥j;	
	Aq. calcis,		℥vj.	M.

Small doses of the tincture of the chloride of iron and brandy were also given at short intervals.

16th. Deglutition is so difficult that almost no nutriment is taken; breathing obstructed; features and extremities livid; temperature 101⅕° to 103⅕°; pulse, 120, 112, 104; respiration, 32, 34, 46; discharge from nares tinged with blood. The mustard-bath was employed, but without producing reaction.

17th. The diphtheritic patches remain on the faucial surface, and the right nostril is plugged by an exudate of the same appearance. Rectal temperature at different hours through the day was 98½°, 98°, 99°, 98°; pulse, 120, 118; respiration, 32, 38; pulse weak and surface cyanotic and cool. About one teaspoonful of brandy was given through the day, and the same quantity of milk; hot bottles applied.

18th. Nostrils discharging freely; temperature, 103°; pulse, 140; respiration, 45, 60. Cry hoarse, pulse very feeble. Died at 11 P. M.

Autopsy, January 19th.—In addition to the diphtheritic exudation already mentioned, occurring upon the faucial and nasal sufaces, a pseudo-membrane was found covering the larynx, trachea, and œsophagus to within one inch of the stomach. The lungs contained numerous points of extravasated blood. No notable change was observed in the appearance of the kidneys, heart, and other organs.

CASE III.—Victor K——, born December 7, 1887. On January 13th, when Victor was thirty-seven days old, his mother called the attention of the resident physician to him, as he seemed seriously sick. His temperature was 103.2°, and his breathing indicated nasal catarrh. On the following day, the 14th, the characteristic grayish-white diphtheritic pellicle was observed on the left side of the uvula. The inability to remove it by brush or washing demonstrated its diphtheritic nature. The temperature on the 14th varied from 99° to 102.4°, the pulse from 88 to 96, and the respiration from 26 to 38, having the Cheyne-Stokes' character. The pulse was weak and the extremities and face cyanotic. On the 15th his temperature was 102°; respiration, 20, with long intervals; and the frequency of the pulse could not be ascertained from the weak action of the heart. Death occurred at 5 P. M. Diagnosis: bronchitis, nasal and slight pharyngeal diphtheria. The right cavities of the heart were greatly distended with blood. No pseudo-membrane was found in the larynx, trachea, and bronchial tubes, but only the hyperæmia of bronchitis. Lungs normal, except hypostatic congestion of posterior portion of each.

CASE IV.—Vincent B——, born December 31, 1887, was apparently well until January 17th, when symptoms of a catarrhal nature attracted attention. The nostrils seemed to be unaffected, but upon the posterior surface of the pharynx was a distinct diphtheritic patch; temperature, 98.5°; respiration, 32 to 40; pulse, 114 to 120.

18th. Discharge from nostrils; temperature, 98.5°; pulse, 116 to 118; respiration, 36. The same nasal and throat wash was used as in the other case. On the 19th the exudate on the surface of the fauces had nearly or quite disappeared.

20th. Nasal catarrh less and infant apparently improving. Pulse, 118; respiration, 28; temperature, 98.5°.

21st. No discharge from nostrils, and fauces apparently free from pseudo-membrane. The infant soon fully recovered.

CASE V.—Hilda M——. This case is fully detailed in the section on "Sepsis." She was fretful when four days old, and at the age of six days an umbilical phlegmon was discovered. The fauces were inspected daily, and when at the age of seven days the grayish-white exudate of diphtheria was observed for the first time covering both tonsils. On the following day the exudate appeared in the right nostril. Death occurred on the tenth day, and at the autopsy, in addition to the phlegmon, the pharynx, larynx, and trachea showed soft, reddish, friable patches of diphtheritic pseudo-membrane partially covering their surfaces. The membrane did not extend into the bronchi.

Diphtheria of the newly-born is sometimes wrongly diagnosticated. Thus in the New York Foundling Asylum, where diphtheria was occurring, the tonsils of an infant a few days after birth presented a grayish-white appearance, and diphtheria was diagnosticated. After its death the curator, Dr. Northrup, discovered a pultaceous state of the surface of the tonsils, but no pseudo-membrane. The disease was not diphtheria. But in regard to the cases related above there can be no doubt of the correctness of the diagnosis, unless in regard to Case III. The occurrence of five cases in so short a time in a rather small maternity service shows that under certain circumstances the newly-born infant exhibits considerable susceptibility to diphtheria.

A very interesting and important subject for consideration arises in connection with these cases—to wit, personal and domiciliary disinfection. The occurrence of so many cases of umbilical phlegmon and diphtheria showed that the maternity ward was infected to such a degree that subsequent patients could not be safely admitted without thorough disinfection. The ward was vacated, the windows, doors, and crevices closed, and forty pounds of sulphur, or two pounds to the one hundred cubic feet of air, were burnt during the day until it was consumed. After some hours the windows and doors were opened, and Drs. Prudden and Cheeseman immediately raised a dust from the floor and bedding and allowed it to settle in culture media. All other sources of infection were excluded from the media. The culture produced so large a number of microbes that they overlaid each other, but they were able to distinguish the Streptococcus pyogenes, which had been previously discovered in the umbilical phlegmon. Although more sulphur was employed than is recommended by the Health Board, the result appears to have been negative as regards destruction of the microbes. Some more efficient mode of domiciliary disinfection should be devised. I recommend to wash the floors, walls, and furniture of an infected room with a strong solution of corrosive sublimate. This might be done frequently during the progress of a case of diphtheria. In order to disinfect the air of an apartment where a diphtheritic patient is under treatment a disinfectant mixture should be placed over the gas, oil, or other stove in shallow pans with broad surfaces, and kept in a state of constant ebullition or simmering. I prefer for this purpose the following prescription:

℞. Acidi carbolici,
Ol. eucalypti, āā. ℥j;
Spts. terebinth., ℥vj–viij. M.

Add two tablespoonfuls to one quart of water for ebullition.

One important advantage arises, I think, from this mode of disinfecting the air—namely, that the physicians and attendants are less likely to convey the disease in their clothing. It is probable that the danger of communicating diphtheria to other children or to obstetrical cases is greatly diminished if the air be sufficiently loaded with the disinfecting vapor. No more cases have occurred in the Infant Asylum since this mode of disinfection was employed.[1]

Although the prognosis in diphtheria of the newly-born is very bad, it is not necessarily fatal, as is seen by the above cases. Does it require, on account of the age, any modification of the usual mode of treatment? Very few, probably, would recommend the internal use of corrosive sublimate for patients so young, but there seems no objection to the local use by the swab or camel's-hair pencil of so weak a solution as that employed by Dr. Oatman and others—two grains to the pint of water. The old remedy of the tincture of the chloride of iron, so long employed as a blood-restorer, and properly prescribed as a chief remedy in diphtheria, which is attended by a rapid destruction of the red corpuscles and progressive anæmia, seems to be a proper remedy for any age. It was employed in the above cases in doses of one to two drops.

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[1] As the ordinary mode of domiciliary disinfection seemed to be entirely futile in the maternity wards where the above cases occurred, it seemed to me advisable to obtain the views of so eminent an authority as Dr. E. R. Squibb of Brooklyn, and he has kindly favored me with the following note:

"Within the past ten years the efficacy of sulphur fumigation against infectious material has been repeatedly denied and reaffirmed upon very good authority, and observations, apparently made with accuracy and care, have been reported from time to time to prove both sides of the question; so that all that can now be said is that burning sulphur is of doubtful efficacy, with the weight of the highest authorities in bacteriology against it. But to this it must be added that it is still largely used by very intelligent bodies in large institutions, boards of health, etc., where it would not be likely long to maintain an unearned confidence.

"How often the fumes are applied dry, and how often moist, no one can tell from the current record, and how many of the failures of the dry gas would be successes in the presence of moisture there is no means of knowing.

"Formerly, when sulphur was burned in closed chambers as a disinfectant, the surfaces were all wetted, and the pot of burning sulphur was set in water or in wet sand, that the heat might evaporate off a constant supply of watery vapor.

"These conditions are now frequently, if not generally, neglected, and where this is the case failure on principle should be the rule.

"Nearly all, if not all, chemical disinfectants are in a state of tension, ready to change on coming in contact with the matter to which they are applicable; and these changes are either by oxidation or deoxidation, and the moment of greatest power or activity is the moment of change, where they, by reacting with infectious matter, pass from a state of tension to a state of rest under new relations. The agency through which these changes almost universally become operative is the vapor of water.

"When sulphur is burned in a close chamber, the dioxide is formed by condensing two molecules of oxygen from the air upon each molecule of the sulphur, and a heavy gas is the result, which tends to settle at the bottom of the chamber and to run out through the lower cracks. Any moisture present is at once seized by this rather inactive anhydride, first forming sulphurous acid, and then, by oxidation from the air, sulphuric acid. The dry gas, or anhydride, not only seizes with avidity all watery vapor in the air, but also the water held in the surfaces of all bodies with which it comes in contact, and in the presence of this moisture only is it ready for further oxidation. Then it is by this oxidation that it deoxidizes the matters with which it is in moist contact, filling the surfaces of these matters first with sulphurous acid, then, by the change, with sulphuric acid; and it is during these changes that its power is exerted.

"If there be no moisture supplied to the burning sulphur, that which was present in the air and the surfaces of the chamber is soon used up, and the dry gas remains indefinitely in a comparatively inactive, ineffective condition. The dry, passive anhydride would necessarily destroy all organisms which breathed in any degree, because breathing surfaces are moist. But in embryonic life, protected by shell, as in seed, if the shell be dry the gas would be impotent. Many bacteriologists have admitted that burning sulphur would kill bacteria, but not germs."

THRUSH.

The terms thrush, sprue, and muguet—the last from the French—are synonymous. They are used to designate a form of inflammation of the mucous surfaces the peculiar feature of which is the presence of points or patches of a curd-like appearance on the inflamed surface. The usual seat of thrush is the buccal membrane, but occasionally it occurs on the faucial and œsophageal surfaces. It is very rare in the subdiaphragmatic portion of the digestive tube, but a few such cases have been reported by Billard and others. It never occurs upon the membrane of the nostrils, larynx, or bronchial tubes, and it very seldom occurs upon any other surface without also being present upon the buccal mucous membrane. Thrush, then, is a stomatitis, pharyngitis, œsophagitis, or gastro-enteritis with the additional element which I have mentioned.

Causes.—The younger the infant the greater is the liability to thrush when the causes favorable for its occurrence are present. It is therefore common in infants under the age of six weeks, and a majority of the cases occur under the age of six months. The common causes of this disease are such as ordinarily develop a stomatitis, prominent among which are improper feeding, indigestion, gastro-enteritis, and the cachectic state, whether arising from prematurity, congenital weakness, or enfeebling diseases. The most common and obvious of the causes alluded to is the use of indigestible and improper food, which produces a gastro-intestinal catarrh, soon followed by stomatitis. Thrush is therefore a common disease among foundlings in institutions where these unfortunates are received, since they not only breathe an atmosphere which is often impure, but are deprived of the mother's milk, and are so frequently given a diet which is a poor substitute for it. Infants in crowded tenement-houses of the cities and in destitute families, whose diet is often very unsuitable, are much more liable to thrush than infants well fed and well cared for in well-to-do families.

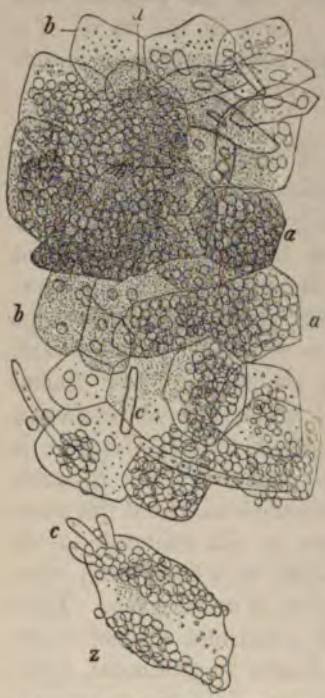
In infants under the age of three months the cause of thrush is often mild, and soon removed by better hygienic conditions and improvement in the diet. An improper diet for a few days, or a slight gastro-intestinal catarrh which quickly subsides when the cause ceases, is sufficient to develop the disease. In the newly-born the frequent use of sweetened carminatives or of sweetened dietetic mixtures administered by the nurse often gives rise to sprue, which ceases when these drinks are withheld and a proper mouth-wash applied. But after the age of six months, and especially after the age of one year, the condition giving rise to sprue is much more serious. After the age of twelve months sprue is comparatively rare, and when it does occur it is usually in the later stages of a protracted and exhausting disease; and in such cases it is an unfavorable prognostic sign. Under such circumstances it occurs even in childhood, youth, and adult life, and is justly regarded as a complication of grave import. Thrush, being a parasitic disease, is believed to be communicable by contact, like the parasitic skin diseases, but not through the atmosphere. Thus in the wards of a foundling asylum the tip of a nursing-bottle used by different foundlings, if not properly cleaned after its use, may be the means of communicating it.

Anatomical Characters.—The first stage of thrush is that of simple inflammation of the mucous surface. The mixed salivary and mucous secretions in the mouth, which are normally alkaline, become acid. There next appear upon the mucous surface minute semi-transparent points or granules, which, increasing, soon become white and opaque. Some of them remain as points, while others, extending and perhaps coalescing with those adjoining, form patches of greater or less extent. The white points or patches are unequally elevated. Their central part, which was first formed, is most raised, while their circumference projects but little above the epithelium. Their highest elevation is ordinarily not more than a line above the surface. They resemble closely in color and consistence portions of curdled milk, and the nurse often mistakes them for such and neglects to call attention to the state of the mouth. They are readily detached by a little force, when the mucous membrane underneath is seen to be in its integrity. Their color in the first days of sprue is white, and sometimes this color continues. In other cases they assume, if the disease be protracted, a yellowish hue.

Their true nature, long unknown, was finally revealed by microscopy. They consist in part of epithelial cells and in part of a vegetable growth. This parasite is the *Oïdium albicans*, discovered by Berg of Stockholm, but more fully described by Gruby and Charles Robin. The roots of the parasite are transparent, and they penetrate the epithelial layer sometimes even to the basement membrane. The branches arising from these rootlets divide and subdivide at an acute angle, and under the microscope are seen to consist of elongated cells with one or two nuclei. The branches or the mycelium is formed by the union of the cells at their extremities. Numerous spherical or ovoid spores are also present surrounding the mycelium and covering the epithelial cells. Haller states that he has identified this parasite with the *Oïdium lactis*, which occurs in milk undergoing acid fermentation. The spores are primarily developed, and are found in the scraping of the mucous surface in the vicinity of the patches of sprue. In two instances in examining the product of thrush removed from the œsophagus I found that the parasitic plant was the *Penicillium glaucum* or a conferva closely resembling it.

We have described the ordinary form of thrush as it occurs in young children, but if the patches are of large size and abundant, and the buccal surface generally of a deep-red color, there is usually some severe prostrating and dangerous disease on which the thrush has supervened. We have already alluded to the fact that thrush in its severe forms often results from and complicates some grave disease, as protracted gastro-intestinal catarrh or a chronic pulmonary malady. Hence some writers who have observed thrush in foundling asylums regard it as one of the most serious maladies of early life. Valleix, in a book of more than seven hundred pages relating to the diseases of children, devotes more than one-third of it to the consideration of muguet, but those pathological conditions pertaining to the digestive apparatus which most observers regard as distinct from sprue, though sustaining a causal relation to it, he includes in the description of muguet. Of 24 cases the records of which he publishes, 22 died, but their death was in most instances due to gastro-intestinal inflammation, which the author describes under the term "muguet." Most writers properly restrict, as stated above, the term thrush, sprue, or muguet to those inflammations of mucous surfaces which are accompanied by the peculiar parasitic outgrowth, regarding the severe subdiaphragmatic inflammations from which Valleix's patients died as distinct from muguet,

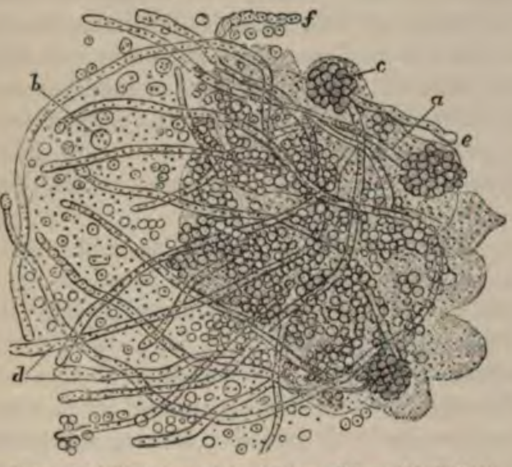
FIG. 137.



Pavement epithelium covered by spores of the *Oïdium albicans* (Ch. Robin).

though sustaining a causal relation to it. In the post-mortem examinations which I have witnessed in the Nursery and Child's Hospital, Infant Asylum, and Foundling Asylum of this city, of those having thrush at the time of death, who for the most part have been infants under the age of three months, I have frequently found evidences of inflammation in every division of the alimentary canal. The parasitic growth was, however, never seen below the œsophagus. Parrot, however, states that he has discovered it in rare instances in the larynx, stomach, and intestines.

FIG. 138.



Spores and Branches of the *Oïdium albicans* (Ch. Robin).

Symptoms.—Thrush in itself does not give rise to any symptoms except those that pertain to the surface which is the seat of the parasitic growth. Other symptoms are not referable to it, but to the diseases in the course of which it is developed and which it complicates. Sprue is preceded and accompanied by the symptoms of gastro-intestinal catarrh or some other disease which disturbs the digestive function, affects the secretion of the digestive apparatus, and causes acidity of the buccal surface. The mucous membrane, upon which the cryptogam is soon to appear, becomes red, hot, tender to the touch. As we have stated above, it gives the acid reaction more or less marked to litmus-paper, and in the scraping from its surface placed under the microscope the spherical or oval spores of the *Oïdium lactis*—or, which is the same, the *Oïdium albicans*—are observed. A few hours later small white points appear, at first scarcely visible, produced by the cryptogamic growth and the epithelial and amorphous matter adherent to it.

These points enlarge, and within a day or two present the well-known appearance of small masses or patches of curdled milk. They are fragile and readily detached, but are soon replaced by others so long as the cause continues. In the worst forms of thrush the surface upon which the cryptogam appears not only presents the ordinary features of severe inflammation, such as heat, redness, and tenderness, but it is sometimes deficient in the natural secretion, so as to present a dry or parched appearance. In these severe cases there is usually in young infants obstinate and protracted inflammation of subdiaphragmatic portions of the digestive tube. The 24 cases related by Valleix, alluded to above, 22 of which were fatal, were of this kind. But the gravity of such cases, in which thirst, anorexia, restlessness, vomiting, diarrhœa, and progressive emaciation occur, is due, as stated above, to the primary disease which has produced the conditions favorable for the occurrence of sprue. If sprue occur, its symptoms should be differentiated from the more pronounced symptoms of the disease which it complicates.

Diagnosis.—This is not difficult, so far as relates to thrush of the buccal surface, for simple inspection reveals its presence. If a particle of one of the patches be placed under the microscope, the mycelium and spores of the *Oïdium albicans* are readily detected. Only the inexperienced could mistake the diphtheritic exudate for the growth of sprue or *vice versâ*. The diphtheritic pellicle penetrates the mucous membrane, from which it is detached with difficulty, leaving underneath a raw and bleeding surface; and it is thick and tough, contrasting in these particulars with the product of sprue. Enlargement of the cervical glands is also common in diphtheria and is absent in sprue.

Particles of coagulated casein upon the tongue and gums bear a close resemblance to the patches of thrush, but their relation to the mucous membrane is simply that of contact, and they are removed by a spoonful of water.

Prognosis.—The duration of thrush varies according to the duration and nature of the primary disease which it complicates. In young infants who have indigestion or slight gastro-intestinal catarrh it is quickly cured by appropriate local treatment if the nutriment given be of the proper kind and the stomach and intestines be restored to their normal state. On the other hand, thrush occurring in the course of chronic and highly debilitating diseases is not so quickly cured, or if cured is likely to return. It does not materially increase the gravity of the malady in the course of which it occurs, but when it complicates a chronic disease it indicates a reduced state of the system, an impairment of the general nutrition, which if it continue is likely to end fatally. As M. Bouchut has pointed out, when Baron states that 109 out of 140 patients with muguet died of this disease, and Valleix, as I have stated above, says that he lost 22 out of 24 cases from the same cause, they attribute to a comparatively unimportant complication what was really due to a grave internal disease. Thrush does not itself cause death, though it may be a sign of bad omen. Death when it occurs is from a visceral affection which precedes and accompanies the sprue, and is likely to continue after every vestige of the latter is removed by local measures, unless it receive appropriate internal treatment.

Sprue is a bad omen if the tongue and buccal surface be dry, hot, and highly injected, the coating of the tongue of brownish color, the infant fretful with the appearance of suffering in its physiognomy, and having progressive loss of flesh and strength. Such symptoms indicate in most instances a fatal form of gastro-intestinal cataarh. On the other hand, in young infants, since indigestion and slight gastro-intestinal derangements are adequate to cause an acid state of the buccal surface and the development and extension of the *Oïdium albicans,* the large majority of the cases of thrush in which the general condition is good and the stomatitis mild are quickly cured by appropriate treatment.

Treatment.—Since the common cause of thrush in infancy is the use of indigestible or improper food, the physician should ascertain the nature and mode of preparation of the infant's diet, and, if it be faulty, should direct one that is better. If the infant be bottle-fed, the mother's milk or that of a wet-nurse should, if practicable, be substituted for the artificial feeding; but if this be impossible, a diet should be selected which bears the closest possible resemblance to the mother's milk in digestibility and nutritive properties.

There is often in thrush an excess of acidity in the digestive tube, and an alkali is required. Trousseau recommends the addition of saccharate of lime to the milk. Children with this disease should also be taken from filthy and damp apartments to those in which the air is pure and dry, and their mouths and persons should be kept clean.

The remedy in common use in the treatment of thrush, and which is usually effectual, is borax. This, if applied sufficiently often to the affected membrane, not only destroys the parasitic growth, but prevents its reproduction. It is commonly employed with honey or in a powder with sugar or dissolved in water. The officinal mel boracis, consisting of one part of borax to eight of honey, is so much used in families that it may be considered almost a domestic remedy. There is, however, an objection to using any application for the removal of thrush which contains either sugar or honey, since either substance remaining in the mouth would rather promote the growth of the parasite. Still, it is desirable to employ a wash of such consistence that it will remain a longer time in contact with the buccal surface than will a simple solution in water. I know no better vehicle for the borax than glycerin, which has the advantage of consistence, does not undergo any chemical change, and has no unpleasant flavor. The borax may be used dissolved in glycerin, with or without some flavoring ingredient:

℞. Sodii borat., ʒj ;
Glycerinæ, ʒij ;
Aquæ, ʒvj. Misce.

Borax should be used four or five times daily, and continued for a time after the disease has disappeared from sight, since the roots of the plant must be destroyed or the branches are rapidly reproduced. It should be applied by a camel's-hair pencil or with a soft cloth upon the finger or a stick. It should be so freely used in extensive and severe forms of the disease that the infant will swallow some, since the entire œsophagus is often also the seat of sprue in such cases. In the intervals between the applications of borax, if the buccal surface be hot, dry, and tender, so as to increase the fretfulness of the infant, it is well to use mucilaginous washes, as the mucilage of acacia or mallows. If the disease continue notwithstanding the use of these measures, the mouth should be occasionally washed with a weak solution of nitrate of silver or sulphate of zinc:

℞. Zinci sulph., gr. ij–iv ;
Aq. rosæ, ℥ij. Misce.

In many cases, however, the treatment of thrush is of less importance than that of the disease which the thrush complicates. The remedial measures which I have mentioned then become subordinate to those employed for the graver disease. When this disease is relieved and the general health improves, thrush is more easily and permanently cured than during the state of febleness and ill-health.

HÆMATEMESIS NEONATORUM AND MELÆNA NEONATORUM.

Hemorrhage from the gastro-intestinal surface occurs in children from various causes. It is a common symptom of intussusception in infants. It occurs from dysentery and purpura and from the syphilitic dyscrasia. It has been observed in polypus of the rectum and in anal fissures. In rare instances it occurs from the irritation of lumbrici, from foreign substances which have been swallowed, and from the ulceration of typhoid fever. Intestinal hemorrhage from such cases is a symptom of constitutional or local disease. But in newly-born infants it sometimes occurs without other symptoms or without other appreciable disease, and therefore is regarded as an essential malady.

Melæna neonatorum was mentioned by Storck in 1750, and various writers at different times alluded to it or briefly described it prior to 1825. In 1825 it was more fully treated of by Hesse than by any of his predecessors.[1] The monograph published by him was valuable, as it contained his own observations and those of contemporary physicians communicated to him, as well as the investigations of his predecessors. Dr. Rahn-Escher of Zurich (1835), Meisner (1838), Kiwisch (1841), Rumpe (1841), Hoffman (1842), and Helmbrecht (1843) published memoirs or related cases of melæna. Several of the best-known authors on diseases of children, long recognized as authorities in this branch of practice, have also written on intestinal hemorrhage, as Billard, Vogel, Rilliet and Barthez, Barrier, Bouchut, West, Eustace Smith, and Goodhart, so that the literature of this disease is no longer meagre.

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[1] *Annalen von Pierer*, 1825, Heft 6.

Age.—In the statistics of Billard, embracing 15 cases, 8 were betweeen the ages of one and six days, 4 between the ages of six and eight days, and 3 between the ages of ten and eighteen days. Of 20 cases embraced in the memoir of Rilliet and Barthez, 9 were at or under the age of thirty-six hours when the hemorrhage began, 5 between the ages of two and four days, 2 between six and eleven days, and 2 at the ages of fifteen and twenty weeks. Of 50 cases collated by Croom[1] from various sources, gastro-intestinal hemorrhage took place in 30 between the first and sixth days, in 8 between the sixth and eighth days, in 4 between the eighth and twelfth days, and in 8 between the twelfth and eighteenth days. The bleeding began in 6 within the first twenty-four hours. These statistics, which correspond with those of other observers, show that in a large majority of cases the hemorrhage occurs within the first twenty-four hours. Hæmatemesis also takes place along with the intestinal hemorrhage in a considerable proportion of cases.

Etiology.—The cause of melæna of the newly-born is involved in some obscurity. To a considerable extent the causes are the same as in hemorrhage from the umbilicus, which we have treated of in a foregoing page. A predisposition to this and other forms of hemorrhage is sometimes inherited. Dr. Rahn-Escher states that the mothers sometimes have digestive ailments or other forms of ill-health, which he thinks produce atony of the vessels in the infants. The infant sometimes belongs to a family of bleeders and inherits hæmophilia. In the *Medical Times and Gazette* for October, 1880, Dr. Croom relates 4 cases in which there appeared to be an hereditary tendency to bleeding. In 1 of the cases the father was subject to hemorrhages; in another the pressure of the forceps produced extensive ecchymoses on the both sides of the head. We have stated in our remarks on umbilical hemorrhage that newly-born infants affected by syphilis are very liable to intestinal and other forms of hemorrhage from the dyscrasia present or from anatomical changes in the walls of the minute vessels, or, as is probable, from both causes. Our article on umbilical hemorrhage contains the statistics of Mracek, who at the autopsies of 160 syphilitic infants observed internal hemorrhages in 42, but in only 4 of these was extravasated blood present in the intestines.

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[1] *Medical Times and Gaz.*, Oct., 1880.

But the majority of the neonati who have gastro-intestinal hemorrhage do not appear to have any inherited dyscrasia or taint of system. Certainly the instances are exceptional in which the infants belong to families of "bleeders" or have the syphilitic dyscrasia. We must look for other causes apart from these. Billard attributes melæna of the newly-born to congestion of the vessels. Says he: "I have examined 15 cases of passive intestinal hemorrhage. . . . . Most of them were remarkable for the plethoric condition of their bodies and the general congestion of their integuments. . . . . In all the large abdominal vessels, the liver, spleen, lungs, and heart were considerably engorged with blood." He adds: "It cannot be too strongly recommended to accoucheurs to allow the umbilical cord to bleed when a child is observed to be in a state of asphyxia; for it has already been seen what serious effects follow from a superabundance of blood in young infants."[1] Vogel says: "The turgesence of the mesenteric arteries and their systems of capillaries, seen even in the physiological state, and produced by the sudden closure of the umbilical arteries, so important in the fœtus, and which arise directly from the hypogastric arteries, may be looked upon as a cause of this disease. An especial thinness of the walls or friability of the affected system of vessels must certainly play a part here, because otherwise this, in reality, very rare form of hemorrhage would have to occur much more frequently. The closure of the ductus venosus Arantii, and especially that of the branch of the umbilical vein opening into the portal vein, deserves more frequent and stricter investigation to explain this hemorrhage."

Rilliet and Barthez attach but little importance to the causes of melæna assigned by writers who preceded them, but state that it is easy to conceive that hyperæmia of the intestinal tube, which is normal in the newly-born, might be increased by atony of the vessels or impeded abdominal circulation, through arrest of the circulation in the portal vein, so that hemorrhage would be liable to occur. Incomplete establishment of respiration, in which congestion of organs occurs, and especially of the intestines, they regard as a predisposing cause. They admit hereditary influence in certain cases, as when a parent has been subject to hemorrhage. M. Bouchut[2] makes three groups of cases of melæna, according to the supposed etiology, as follows: First, melæna from purpura; second, from passive congestion, the result of compression at birth; third, from acute or chronic inflammation of the gastro-intestinal surface. Dr. West believes that tedious and difficult labor, in which the head of the child is compressed and abdomen injured, is an occasional cause of intestinal hemorrhage. The tardy and difficult establishment of respiration he also thinks may be a predisposing cause, but he adds, "very often no reason can be assigned for it." In two post-mortem examinations which he made no adequate cause was discovered. Braun[1] mentions among the probable causes, congestion of mesenteric vessels, pressure during birth, heredity, intra-uterine malnutrition. Steiner[2] believes that intestinal hemorrhage occurs sometimes from a round perforating ulcer due to fatty degeneration of the arteries. Hecker, Buhl, Spiegelberg, and Leopold Landau relate cases, six in all, in which abscesses or ulcers were observed in the stomach or duodenum, or in both. Landau expresses the opinion that these lesions occurring in the gastro-duodenal surface are produced by small embolisms. Reinbold[3] relates the case of an infant born May 15th, who had hæmatemesis and melæna on the first day, and died May 17th. There was apparently epigastric tenderness. All the organs were anæmic, and the stomach contained seven or eight ulcers with edges slightly raised. No emboli could be discovered, but the umbilical vein contained a brownish-red clot.

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[1] *Treatise on the Diseases of Infants.*

[2] *Traité pratique des Maladies des Nouveaux-nés.*

On the other hand, J. Halliday Croom, lecturer on midwifery and diseases of women at the School of Medicine, Edinburgh, made the autopsy of a child that died of melæna at the age of half a day. The gastro-intestinal surface was carefully examined, and no abscess, ulcer, or erosion was discovered, but some congestion was observed in the lower part of the intestine. He alludes to another case, described by Helmbrecht, in which the only apparent morbid condition was congestion of the rectum. In another case, observed by Dr. Croom, an infant of three weeks, previously well, died of hæmatemesis and melæna. Both auricles contained firm clots, and in the aorta was a clot partly decolorized. The only abnormal appearance in the digestive tract was capillary injection of the duodenal surface.[4]

Epstein of Prague[5] in an interesting monograph on melæna neonatorum states that hemorrhage occurs in the newly-born from various causes—from disturbance of the circulation leading to congestion, from disease of the vessels, and from disease of the blood itself. In infants born partly asphyxiated after tedious labor, or in weakly infants with atelectasis, Epstein says that hyperæmia, hemorrhagic erosions, ulcerations, and actual hemorrhage of the gastro-intestinal surface are likely to occur. He believes that the most common cause of melæna is temporary congestion of the finer capillary vessels. When the surface of the stomach has been sprinkled with ecchymoses, small gastric ulcers have been present, caused by emboli in the gastro-duodenal vessels resulting from thrombi in the umbilical vein.

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[1] *Compendium des Kinderheilkunde*, Vienna, 1871.

[2] *Diseases of Children.*

[3] *Deutsche med. Woch.*, No. 28, 1881.

[4] *Med. Times and Gaz.*, Oct., 1880.

[5] *Allgem Wien. Med. Zeit.*, No. 49, 1882.

From the above quite numerous observations we are able to affirm that hemorrhage from the stomach and intestines in the newly-born occurs from different causes, prominent among which are—1st, hæmophilia; 2d, inherited syphilis; 3d, congestion of the gastro-intestinal surface; 4th, ulcers occurring especially in the stomach, whether produced by emboli resulting from thrombosis in the umbilical vein or from other causes.

Diagnosis; Prognosis.—If the infant vomit blood, the nipple of the mother or wet-nurse should be inspected, for a considerable amount of blood is sometimes drawn by suction from the nipple. If no abrasion or sore be discovered upon or around the nipple or upon the lips or in the mouth of the infant, we may assume that hemorrhage is occurring from the stomach or upper part of the intestines of the infant. The presence of blood upon the diaper without any fissure upon the anus or external source of its occurrence is evidence of intestinal hemorrhage. The blood is dark and more or less changed by digestion or the action of the intestinal secretions if it have lain some time in the intestines. The pallor of the infant and increasing feebleness are evidence of the loss of blood. But in one instance myself and two other physicians were deceived by a midwife who had loosely ligated the umbilical cord, so that fatal hemorrhage occurred from it. The case was reported as one of intestinal hemorrhage, and was recorded as such in the statistics of the Health Board. The source of the hemorrhage was ascertained by a post-mortem examination which we were fortunate in obtaining. The gastro-intestinal surface was normal except its extreme bloodlessness and pallor.

The *prognosis* is in most instances unfavorable, but if the infant be strong and the amount of hemorrhage small, we may hold out some encouragement of a favorable result. It is possible, indeed, that a considerable amount of blood be lost and the infant recover. But weakly infants who have an abundant hemorrhage sink rapidly. If the bleeding do not cease in twenty-four hours, death will probably be the result.

Treatment.—The child should be nourished at the breast if possible, and a little ice-water be given with a spoon along with the breast milk. If the infant do not have breast milk, peptonized milk may be employed. The food of whatever kind should be given cool. It has been recommended to apply the ice-bag over the abdomen while warm applications are made to the extremities. One grain of tannic or gallic acid dissolved in cool water may be given every hour, or one or two drops of turpentine. If the child exhibit signs of failing strength, a few drops of brandy should be given at short intervals in cold peptonized milk.

DIARRHŒA.

The colostrum, or the first secretion of the mammary glands after parturition, contains more oily matter and sugar than occur in the subsequent secretion. In consequence of this peculiarity in its composition the colostrum has a laxative effect by which the meconium is expelled. If the mammary glands continue to secrete colostrum after the first week, diarrhœa is likely to result. A more common cause of diarrhœa of the newly-born is the employment of various sweetened mixtures by mothers or nurses in the belief that the breast milk is inadequate, or they are employed for the purpose of relieving the supposed colicky pains whenever the baby frets. Cane-sugar added to the various mint teas not only gives rise to diarrhœa, but also in time to more or less gastro-intestinal catarrh and stomatitis, with the occurrence of sprue. Sprue is more common in the newly-born than at any other period of life, and it can usually, according to my experience, be traced to the use of improper sweetened mixtures. The infant immediately after birth may be given a little sweetened water or a teaspoonful of sweet oil to aid in the expulsion of the meconium, but subsequently, in the great majority of cases, no carminative or nutritive mixtures are required. The breasts of the mother if she have the usual health furnish all that is needed. The neonatus requires almost no nutriment during the first three days, and the breasts furnish but little during this time, but frequent traction upon the nipple promotes the mammary secretion, and after the third day, in ordinary cases, sufficient nutriment is obtained from the breasts to supply the wants of the system and promote a healthy growth. If what is natural were left to itself, and no artificial measures were employed, the result in most instances would be good; but the unfortunate practice of filling the infant's stomach with various admixtures disturbs normal digestion, impairs the appetite, causes colicky pains, vomiting, and diarrhœa, and, if persisted in, gastro-intestinal catarrh. The late Dr. James Jackson of Boston drew attention to the diarrhœa of young infants produced by the cause which we have mentioned. In the cases which he observed the green fermenting and unhealthy stools ceased and a more normal state of the digestive apparatus was produced by forbidding the use of the superfluous and injurious food and drinks which had been given to supplement lactation in the mistaken belief that more food was required. Food in excess, even if it be of the proper quality, even if it be breast milk, usually causes diarrhœa if it be not vomited, since, not being fully digested, it undergoes fermentative changes, and acts as an irritant until it is expelled. But food containing a large proportion of sugar is laxative in consequence of the sugar.

Diarrhœa in the newly-born, whatever its cause, should be immediately arrested. After the meconium is removed by the action of the colostrum, three daily evacuations from the bowels are sufficient. A larger number is usually attended with loss of flesh and strength. The use of sweetened mixtures, which nurses are in the habit of administering when infants are not well, as catnip, fennel, or aniseed tea, we repeat, must be strictly forbidden. A mother with a sick and fretful infant usually applies it to the breast too frequently, even every half hour during the day. This should also be strictly forbidden. The infant, like the adult, should take food at stated intervals, so that the digestive organs may have some respite from the task of digestion. The application of the infant to the breast twelve times in twenty-four hours is sufficient for its nutrition, and the mother's health is better preserved and her milk of better quality than when she is deprived of the needed rest by more frequent suckling. If the infant be unfortunately deprived of breast milk and be bottle-fed, the utmost care is required in the selection and preparation of the food, as well as in determining the amount of food to be given and the frequency of feeding. Facts relating to this important subject have been presented in preceding pages. Young bottle-fed infants with too frequent and unhealthy stools sometimes do well with peptonized milk, especially if flour prepared by long boiling be added to it. In New York City some of the shops contain barley flour subjected to the heat of boiling water seven days, and wheat flour five days, designed for nursery use. The important advantage possessed by this flour is that its starch is converted into the soluble form, and a considerable part of it into dextrin, so that it can apparently be digested by young infants more readily than ordinary flour. A teaspoonful of either of these flours may be added to twenty teaspoonfuls of peptonized milk for young infants with diarrhœa. The beneficial effect of the flour is due largely to its mechanical action in separating the particles of casein, so that they can be acted on more readily by the gastric juice, which in young infants is secreted in small quantity. Sometimes in treating the diarrhœa of young infants, if it be severe, it is better to withhold entirely milk in any form a few days, and give in its place a light gruel prepared by adding the barley or wheat flour to water in the proportion of one to sixteen or twenty. When it is heated to the boiling-point to destroy any microbes in the water, place it upon ice or in cool water, and when its temperature is reduced below blood-heat the white of an egg or half an egg may be added with sufficient salt. This farinaceous diet sometimes aids materially in checking the diarrhœa. Dextrin can be digested by the youngest infant, and the little patient may be sufficiently nourished for a week or more by the wheat or barley flour prepared in the manner stated above, with the salt and perhaps white of egg added.

If the diarrhœa do not cease by the use of the proper diet given in suitable quantity at proper intervals, which should not be oftener than two and a half to three hours, medicinal treatment is needed. I have found the following prescriptions very useful for the diarrhœa of infants under the age of one month, as well as for those that are older:

℞. Bismuthi subnitrat., ʒiij;
Pepsini puri in lamellis, ʒj. Misce.

Give as much as goes on a ten-cent piece before each feeding.

℞. Bismuthi subnitrat., ʒij;
Misturæ cretæ, ℥ij. Misce.

Shake bottle, and give twenty drops midway between the feedings to a child of two weeks. This alkaline mixture neutralizes the lactic, butyric, or other injurious acid which may exist in excess in the stomach or intestines. In some instances one or two drops of paregoric, given three or four times daily, have a salutary effect in diminishing the peristalsis.

CONSTIPATION.

In the infant constipation results from several different causes. The most serious and obstinate form of it, to which the term obstipation is more appropriately applied, arises from intestinal malformations. In rare instances congenital obstruction occurs in the small intestines. It is sometimes produced by cystic tumors or twisting of the intestine. Congenital stenosis occasionally occurs at the ileo-cæcal orifice. Thus in the *Transactions of the London Pathological Society* for 1870 is the history of a case in which there was such narrowing of the ileo-cæcal orifice, believed to be congenital that a No. 9 catheter could barely be passed through it. The patient lived until his thirty-second year, but throughout his life suffered from constipation and colic. After his death the ileum next to the ileo-cæcal valve was found to have a diameter of seven inches, while the large intestine was much atrophied and its entire lumen contracted from disuse. Occasionally the stenosis occurs a little above the ileo-cæcal orifice, and rarely in the duodenum at the point of union of the pancreatic or bile-duct with the intestine. The obstacle in some instances appears to be hypertrophied valvulæ conniventes, the edges of two opposite folds being more or less adherent. Such congenital intestinal obstructions—whether, as is probable, produced by inflammations in the fœtus or from simple perverted nutrition; whether arising from the syphilitic cachexia or other cause—of course retard the evacuations according to their location and the amount of closure. The same degree of stenosis in the colon or rectum obviously causes a more constipating effect than in the small intestines, since the latter have more mobility than the former, and their contents are more liquid.

But the most common of the congenital obstructions in the intestines occur from malformations of the rectum. These malformations vary considerably in different cases. They may be classified in at least four different groups: 1st. The anus may appear normal, but instead of the normal rectum two cul-de-sacs are present, representing the upper and lower ends of the rectum, and connected by an occluded segment of the rectum or by a firm fibrous cord. 2d. The anus is absent, and the rectum has a fistulous opening in the perineum, or through the scrotum in the male or vulva in the female. In the embryonic development the outlet of the rectum was formed too near and encroached upon the sexual apparatus. 3d. The anus is absent, and there is no external fistulous opening representing the anus, but the rectum opens at some point upon the mucous membrane of the genito-urinary apparatus. 4th. Anus absent and the entire lower part of the rectum obliterated. The upper portion of the rectum terminates in a cul-de-sac in the neighborhood of the promontory. Some of these malformations do not prevent the discharge of fecal matter, but when there is closure of the rectum and no fistulous opening, of course no evacuation of the intestines can occur unless relief be obtained by surgical measures. In the ordinary form of occlusion a portion of the rectum is represented by a cord, or a firm, unyielding septum shuts off the lower part of the rectum from that above, so that defecation is impossible. The infant with this serious malformation takes the breast for a time like other infants, but the intestines soon become distended with fecal matter, and restlessness from the distension and vomiting occur. The only mode of relief is by an incision or puncture through the obstruction; but a large proportion of infants with this obstructive malformation die whether operated on or not. The incision or puncture should be made as soon as the obstruction is discovered, and if successful in reaching the distended intestine above the malformation, the passage thus made should be kept open by tubing of the proper size if the infant live. If the operation be unsuccessful in releasing the imprisoned fecal matter, an artificial anus may be made on the left or right side. But operative measures in these cases pertain to surgery, rather than to midwifery practice.

The great length of the sigmoid flexure in infancy, and the curvatures which occur in consequence, more in number than in older children, tend to retard the descent of fecal matter and promote constipation. In the adult numerous depressions and inequalities in the colon retard the downward movement of the intestinal contents, but in infancy the surface of the colon is comparatively smooth and even, and the detention, so far as any exists, occurs from the curvatures or loops, which are sometimes twisted partially on their axes. The sigmoid flexure is so long under the age of ten, and especially of six months, that the curvatures usually lie in part to the right of the median line, and even in the right iliac fossa. Those who have witnessed the post-mortem examinations of young infants in the asylums find no difficulty in accepting the statement of certain writers that the curvatures or loops in the sigmoid flexure, which sometimes extend as high as the umbilicus, and laterally to the right iliac fossa, cause habitual constipation.

Occasionally in young infants, as well as in those who are older, the intestines act sluggishly from insufficiency of food. Thus the infant sometimes hangs an unusually long time on the breast, and the mother or wet-nurse believes it to be a hearty nurser, when there is really a deficiency of milk, and the stools are scanty and infrequent from lack of material: under such circumstances the infant is restless when away from the breast, or, not being fed, loses flesh, and soon has the appearance of one in ill-health. These symptoms disappear by a more liberal allowance of food of proper quality. Thus, recently a young infant was brought to me suffering from constipation and fretfulness, with progressive loss of flesh and strength and with abundant urination. Its only food, prepared through the advice of a physician, consisted of a teaspoonful of condensed milk to one pint of water. By a more liberal supply of food the constipation disappeared.

Again, a constipated state of the bowels occasionally occurs in infants who nurse heartily and seem to obtain a sufficient quantity of milk; and the cause of it appears to be in the state of the digestive organs, and not in the milk. We find now and then that breast milk has a constipating effect, although we discover nothing to cause this result in the mother's diet or health. The comparison of ordinary breast milk with colostrum may furnish an explanation of the constipation under such circumstances. Colostrum is known to be more laxative than ordinary milk, and it differs from it chemically in containing more butter, sugar, and salts. Hence the theory seems plausible that when breast milk is constipating these elements occur in less than the normal quantity, and we will find that treatment suggested by this theory tends to obviate the constipation.

Constipation has also been attributed to a deficiency in the intestinal secretions and to too great viscidity of them from lack of water. Deficient peristalsis, whether from congenital weakness or other cause, also leads to constipation. The use of starchy foods without sugar or with but little sugar also sometimes has a constipating effect.

Gautier of Geneva, Switzerland, states that an anal fissure is a common cause of constipation whether in the newly-born or older infants. If such a fissure be present, pain in defecation might instinctively lead the infant to resist the desire to evacuate the bowels and to postpone the act, so as to establish a constipated habit; but if such fissures are common in this country, except in the syphilitic, they have escaped our notice.

Finally, constipation has a tendency to perpetuate itself, since retained feculent matter becomes more consistent and firmer, and the contractile power of the muscular tissue becomes weakened by over-distension.

Symptoms.—When there is a mechanical cause of scanty and infrequent defecation, the acuteness of the symptoms and the suffering are usually proportionate to the degree of obstruction. In cases of complete obstruction of the intestines, as in imperforate rectum, fecal accummulation occurs above the obstruction. Under such circumstances distension of the abdomen, vomiting, fretfulness apparently from the abdominal pain, and progressive loss of flesh and strength, indicate the serious nature of the disease.

In constipation from other causes—that is, without obstruction except such as arises from fecal accumulation—the condition of the infant may attract little attention at first; but if it do not have proper evacuations it soon begins to suffer in its health. Fretfulness, an unhealthy physiognomy, vomiting and more or less fever occur, until the patient is relieved of the ailment.

A beautiful and conservative provision in the system is that by which vicarious functions are established to relieve organs which imperfectly perform their part. While the intestinal surface is to a great degree eliminative, so that noxious and effete products are expelled from the system in the stools, it possesses also in a high degree an absorbent function, as all who employ rectal alimentation are aware. If the intestine fail to perform its function of defecation, so that feculent matter collects within it and begins to exert pressure on the intestinal surface, more or less of the liquid portion is taken up by the absorbents, and, entering the general circulation, it finds a mode of escape through other emunctories. The general ill-health or languor, the furred tongue, foul breath, and pain in the head which characterize these cases are no doubt due to the absorption into the blood of noxious products derived from retained feculent matter. But cases to which this description is applicable are not common in early infancy. In the infant the retention is often only in the rectum or rectum and sigmoid flexure, and the symptoms are mild and are relieved by free evacuations which are easily obtained. Between these mild cases and the graver forms of constipation, such as result from mechanical obstructions, there is every intermediate grade, attended by symptoms proportionately severe.

Treatment.—It is very important that constipation in the infant should be detected and promptly treated. Not only its present health, but future well-being, requires this, for the longer the constipated habit continues the more difficult is the cure; and an examination of the records of extreme constipation in adult life which are found in medical literature reveals the fact that in many instances the sluggish state of the intestines commenced in early infancy. The following case, observed by Renauldin and related by Dr. Copland in his *Medical Dictionary*, may be given as an example: A medical officer in the French service had been constipated from birth. He ate like others, but habitually had only one stool in a month or two months, and at the age of forty-two three to four months elapsed between the evacuations. His abdomen was greatly distended and painful, and he seldom passed more than four to six stools in the year; but he lived until the age of fifty-four years. After his death the constipation was found to be due to a fibrous but incomplete septum only one inch above the anus, the result, apparently, of a malformation in the fœtal development. Even when no malformation is present constipation in adult life can frequently be traced back to infancy.

Usually it is best to commence the treatment of constipation by an enema, which softens and removes the hardened masses which have collected in the rectum and the adjacent part of the large intestine. For a young infant tepid water or tepid water containing a little soap or salt usually suffices to produce an evacuation. No possible harm can result from rectal injections when properly employed; and as they commonly act promptly, without causing pain and without any depressing effect, they constitute an important part of the treatment in all forms of constipation. I have sometimes, in cases of habitual constipation, ordered for young infants the daily injection of three teaspoonfuls of sweet oil and one of castor oil. Injections should always be prescribed instead of medicine by the mouth when there is reason to believe that the cause of the constipation is mechanical, as from the great length and many loops in the sigmoid flexure. There are cases of constipation from this cause for which injections should be employed daily for many months, and if given gently, with a proper [illegible] instrument, they ultimately give complete relief, and without producing any injurious effect. One of the meat broths or a gruel of some farinaceous substance may sometimes be advantageously employed for the same purpose.

In the common forms of constipation, in which the cause is feeble peristalsis or scanty intestinal secretions or the use of food of too constipating a nature, we should endeavor to render the ingesta more laxative. Prof. Jacobi has recommended for this condition to give a lump of sugar dissolved in water at each nursing. I have employed the sugar of milk, given in half-teaspoonful doses, to young infants also at each nursing, or several times through the day if required. Manna dissolved in hot water is also an old remedy for the same purpose.

Glucose, into which starch is converted in the process of digestion and also by the action of the diastate of malt, is also laxative. The various foods of the shops which contain glucose derived from barley or other flour by the agency of malt, employed as directed by the late Baron Liebig, are therefore useful in the treatment of habitual constipation in infants. Of four constipated infants in the New York Infant Asylum to whom Horlick's "sugar of malt" was given, three were relieved. Any of the glucose preparations can be given quite freely to a constipated infant without impairing the digestive function or producing other ill-effect, so long as no more than the normal evacuations are produced; and I consider them among the best and safest of the foods for the relief of constipation in infants. But glucose or grape-sugar is only feebly laxative; probably not more so than cane-sugar.

The ordinary purgatives should not be given habitually to relieve a constipated habit. They are likely to irritate the intestines, causing a catarrh, or else, the intestines becoming accustomed to their action, a large dose is required. If possible, the bowels should be kept open by dietetic and hygienic measures. A light oatmeal gruel, long boiled, mixed with salt and considerable sugar, given at or between the nursings, sometimes has the desired effect, especially if in addition to the salt it contain considerable sugar. We may aid in increasing the peristalsis and overcoming the constipation by the massage treatment over the bowels. The fingers lubricated with any kind of oil, should rub and knead the abdominal surface. I have seen the best results from this treatment. Cold applications over the abdomen, so highly recommended by Trousseau in adult cases, cannot be safely employed in infancy, especially in early infancy. A well-known remedy in adult cases is the use morning and evening of a tumblerful of cold water. Water may also be added in considerable quantity to the ingesta of the constipated infant.

Although, as stated above, we deprecate the necessity of using habitually purgative medicines for constipation, sometimes they are required, but if a laxative remedy which aids in the nutrition be prescribed, there is no objection to its use. Such a remedy is the following:

℞. Ol. morrhuæ, ℥iv;
Aq. calcis,
Syr. calcis lactophos., *āā.* ℥ij.

Shake bottle and give half a teaspoonful three times daily to young infants. But this remedy, useful in some cases, in others disappoints our expectations. If it be necessary to employ one of the recognized purgatives, the safest and best in my opinion is calcined magnesia given in the following formula:

℞. Magnesia calcinat., ℥j;
Sacchari lactis, ℥ij. Misce.

Fifteen grains to a drachm, according to the age, may be given to infants, and repeated as may be found necessary.

The newly-born infant when in health ordinarily has about three stools daily, but one free evacuation may be sufficient. We know that the function of defecation is, to a certain extent, under the control of habit. Adults who have evacuations at a certain hour feel the need of them each day as that hour arrives. We should endeavor to encourage this habit in infancy and childhood.

Acute Hæmoglobinuria of the Newborn (Winckel's Disease).

Winckel[1] in 1879 experienced an endemic hæmoglobinuria in 23 children, associated with cyanosis, icterus, and hemorrhage in the different organs, with a fatal termination, on the average, in thirty-two hours. The main pathological conditions discovered after death were swelling of Peyer's patches and the mesenteric glands, discoloration of the renal pyramids, with dark lines of hæmoglobin, and fatty degeneration of important organs.

Acute Fatty Degeneration of the Newborn (Buhl's Disease).

There was observed in 1861, by Buhl,[2] a disease of infants during the first few days of life, characterized by cyanosis, vomiting, icterus, bleeding from the umbilicus and intestines, hemorrhages in the brain, lungs, pericardium, and peritoneum, along with advanced fatty changes in the liver-cells, heart-muscle, alveolar spaces in the lungs, renal epithelium, and intestinal villi, following a parenchymatous inflammation. This disease, rare in human medicine, occurs not so infrequently in veterinary practice.[3] The prognosis is unfavorable. It is not known whether a milder form of the disease exists which may end in recovery.

Scleroma Neonatorum.

This is a disease of children prematurely born, of those which are ill-developed and ill-nourished, associated occasionally with syphilis or pneumonia, with fatty degeneration of the organs, or with heart defects. It is characterized by a hardening of the integument on the calves of the legs, the thighs, the buttocks, and the trunk, but not the breast. The temperature is very much below normal, the pulse is slow, the cry feeble. The explanation of the hardened and thickened skin is to be found in an œdema of the subcutaneous connective tissue. An ingenious explanation was at one time offered—that there was in these children a solidification of the palmitic acid in the subcutaneous fat, which is found in much greater proportion to the other fatty acids during infancy than in adult life.

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[1] *Geburtshülfe*, 1889.

[2] Hecker and v. Buhl: *Klinik der Geburtskunde*, i. 296.

[3] Runge: *Krankheiten der ersten Lebenstage*.

The prognosis of the disease is in the main unfavorable. The treatment should consist in the administration of stimulants, the exhibition of as much peptonized milk as the alimentary canal can absorb—given perhaps by the system of gavage—and, above all, artificial heat, best furnished by an incubator. By this last means very gratifying results have been secured in Paris.

SURGICAL DISEASES OF EARLY CHILDHOOD.

By STEPHEN SMITH, A. M., M. D.,

New York.

Introductory Remarks.

The principles which govern the practice of surgery among children do not differ materially from those established for adults.[1] There are, however, certain peculiarities of childhood that should always be considered both in the study of the affections of that period and in the choice and application of remedial measures.

In the investigation of the affections of childhood, whether due to disease or accident, the surgeon must rely much more on observation and manipulation in arriving at a correct conclusion than in the diagnosis of similar affections in adults. The child can give no proper history of its disease, and cannot intelligibly describe its symptoms. To render observation and manipulation most useful and effective it is of the utmost importance to approach the patient in such manner as to gain his full confidence. The natural timidity of the child is intensely exaggerated by a painful disease or a severe accident, and its apprehension of being injured reaches its climax on the appearance of the surgeon. But with care and gentleness this fear, and consequent excitement, may generally be quicky overcome, and the sufferer will then exhibit the symptoms and signs by which his affection, whatever it may be, naturally expresses itself to the observer.

In childhood all of the physiological processes are more active than in later periods of life. There is, therefore, greater susceptibility to exciting and depressing causes in early life. Though the child's system quickly responds to stimulants, it as readily yields to depressants, and the fluctuations are so prompt, and often so extreme, that great care must be exercised to avoid conditions liable to induce these results. Excessive pain, long continued, and sudden loss of blood, are very depressing and fatal to child-life. But from the depression due to either cause the child quickly rallies if the effect ceases before the exhaustion is extreme. Children are also less liable than adults to diseases due to blood-poisoning, as septicæmia and pyæmia, owing to the rapid elimination of the waste products of the body.

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[1] In preparing this article I have accordingly drawn freely upon my work on *The Principles and Practice of Operative Surgery.*

The pulse and temperature of the sick or injured child are not as indicative of the physical condition as in the adult. The pulse fluctuates from unimportant causes of stimulation or excitement, and the temperature may reach high degrees when the disease has not undergone any serious change.

The liability of children to the exanthemata must always be borne in mind. Scarlet fever has so often appeared after operations as to lead to the suggestion by Sir James Paget[1] that there is a peculiar liability to this disease after operations. It is certainly very important to inquire especially as to the exposure of the child about to be operated upon to any form of contagious disease to which it may be susceptible.

ANÆSTHETICS.

However dangerous chloroform may be, considered as an anæsthetic during operations on adults, it has uniformly given good results in children. It has many positive advantages over ether. It is agreeable to the child, and is not followed immediately by the distressing symptoms which so alarm the patient's friends when ether is employed.

ANTISEPSIS.

In the operative treatment of the surgical affections of childhood antisepsis is as important as in the adult. Powerful antiseptic remedies should, however, be used with greater caution in operations on children, owing to their more rapid absorption.

The principles which should govern in their case has thus been formulated (Hacker):

"Abundant disinfection of the wounds by irrigation with antiseptic fluids should be practised. These fluids prevent foul putrefaction after thorough cleansing of the parts surrounding the wounds. During an operation the germs of infection should not be brought by means of the atmosphere, fingers, instruments, or any other object which comes in contact with the wound. If any are carried to it they are rendered harmless by the irrigation, and, at the same time, blood-clots and secretions from the wound are removed. Wounds which have not been under treatment till some time after the injury, and hence may have been infected, must be persistently irrigated with the stronger antiseptic solutions in all directions and in all corners and pockets: if necessary, incisions are to be made which may afterward be utilized for inserting drainage-tubes.

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[1] *Clinical Lectures and Essays.*

"Perfect hæmostasis during and after the operation must be secured thus: All bleeding vessels, even the smaller ones, are seized, and ligatured with disinfected ligatures, in order to obtain union by first intention and to prevent subsequent hemorrhage.

"Free drainage and moderate compression are obtained by the use of inserted perforated rubber tubes, providing an exit for the secretions and preventing the accumulation of the same in the pockets of the wound-cavity, so-called dead spaces; light compression is applied to aid the carrying off of the fluids of the wound and the apposition of the surfaces by means of a bandage, which must never cord.

"Union by first intention must be secured, if possible, by bringing and also maintaining the surfaces of the wound in exact contact with one another. This most rapid method of healing best protects the wound from the collection, putrefaction, and absorption of the secretions. After the removal of the blood-clots the skin should be exactly apposed by deep and superficial stitches, except where drainage-tubes open.

"An antiseptic dressing, containing antiseptic materials, is applied, in order to take up the secretions flowing from the drainage-tubes, from the clefts, or from the surfaces of the wound, as the case may be, thus preventing the decomposition of the secretions and closing the wound against putrefactive agents from without: in order that not even a small amount of blood and secretion shall reach the surface of the dressing, quite a large piece of impermeable material is placed over the first layers of the dressing, under which the secretions spread into the absorbent material, and finally (but only where very abundant) reach the surface at the edges of the dressing.

"Infrequent and cautious change of dressing is necessary in order to obtain for the wound the rest which is so important for its healing and to avoid every irritation. The dressing should not be renewed without good reason—viz. to remove the stitches and tubes, or when a high temperature points to obstruction to the exit of the secretion and to the consequent process of decomposition in the wound, or when the secretion has reached the edge of the dressing, so that it comes in contact with the atmosphere; when the dressing is changed the wound should be touched as little as possible; the cavity of the wound is not syringed out, except when first intention and an aseptic course have not been attained; the tubes are tested, and, if obstruction requires, they are withdrawn and syringed out; the edges of the wound are cleansed with moist cotton-wool and then the dressing applied."

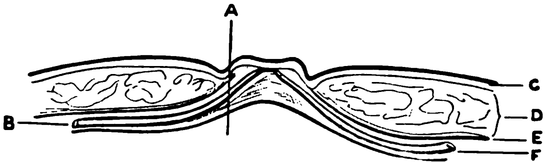
THE UMBILICUS.

Hemorrhage from the umbilicus occasionally occurs, and may be slight or severe. If slight, it is probably caused by some local condition, and will yield to compression or to styptics, as persulphate of iron, styptic cotton, or nitrate of silver. If, however, it is severe, the cause must be traced to defective circulation of the deeper vessels, as of the liver, or to changed conditions of the blood. Grandidier collected 220 cases, of which 84 had icterus neonatorum, and 61 had petechiæ in various places.

The treatment of the latter cases by compression and styptics results in failure, and more radical measures should be early adopted. In general, the hemorrhage will be controlled by passing a needle through the mass, and applying a thread, in the form of a figure of eight, around it. If the surface from which blood escapes is large, two needles should be passed at right angles to each other, and the threads may be loosely wound around them.

Dr. Daken[1] advises to underrun the umbilical arteries with a carbolized hare-lip pin or long needle in the following way: The parts being made aseptic, the child is placed on its back, and its thighs flexed as much as is convenient; if necessary, a few inhalations of chloroform may be given, but he has not had difficulty without it: the operator stands on the left side of the child; if the child is crying and its abdominal walls are tense, advantage must be taken of an interval when the abdomen is lax to seize between the thumb and finger of the left hand about an inch of the walls, exactly at the level of the lower edge of the umbilicus. On tightly pinching this up, the cord of the umbilical arteries (hypogastric) will be felt within the grasp. This will always happen if the operator is careful in choosing the end mentioned, as the vessels are here coming to the surface, and there is no difficulty in making the tips of the fingers and thumb meet beneath them. If the attempt be made even a quarter of an inch nearer the pubes than this, the arteries will slip away from between the finger and thumb, as they are too deep to be included in the pinch (Fig. 139).

FIG. 139.



Vertical Section through the Umbilicus and Linea Alba: *A*, level of pin; *B*, umbilical artery; *C*, skin; *D*, superficial fascia and fat; *E*, aponeurosis; *F*, umbilical vein; *G*, peritoneum.

It is easy, now they have been secured, to pass the pin beneath them, and there is no risk of wounding the intestines, as these are pushed down by the tightly-opposing finger and thumb. The hemorrhage ceases directly the pin has been properly passed; if by chance it continues, a figure-of-eight ligature should be adjusted over the pin. The point of the pin is covered with a bit of cork and dry dressings applied. The pin loosens in a few days sufficiently to allow of its easy removal. It is found by experiment that the pin passes into the abdominal cavity about one-sixteenth of an inch, and hence it is not free from danger. This operation should not be resorted to until simpler methods, already mentioned, have been employed and failed.

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[1] *Lond. Lancet*, Mar. 30, 1889.

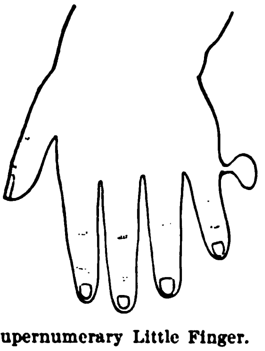
A fistula is sometimes discovered at the umbilicus of infants, and is congenital. It is due to a patent urachus, and often discharges urine. An abscess may form in the course of the urachus, due to the partial closure, and when it finds its way to the umbilicus it opens the tube, and a fistula is the result. Any cause of obstruction to the free discharge of urine from the bladder is liable to create a urachal fistula or abscess, as phimosis, calculus, etc.

The treatment should aim to overcome any existing conditions which cause a set-back of the urine, as circumcision, phimosis, or dilatation of a narrow urethra. If the fistula is a constant outlet for pus or urine, it should not be closed; but if the discharge is slight and inconstant, a ligature may be applied to the papillary growth from which the discharge takes place, or nitric acid may be applied, or the stem may be dissected off around the opening and the wound closed with the twisted suture.

SUPERNUMERARY DIGITS.

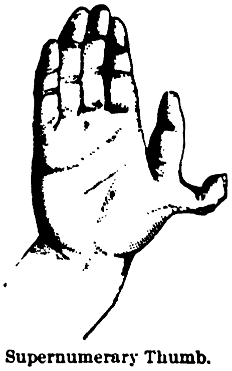
There are four varieties of supernumerary fingers and toes:[1] (1) A deficient organ may be attached loosely or by a narrow pedicle to another digit or to the hand or foot (Fig. 140). (2) There may be a more or less developed organ, free at its extremity, and articulating with the

FIG. 140.



Supernumerary Little Finger.

FIG. 141.



Supernumerary Thumb.

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[1] Annandale: *Malformations of the Fingers and Toes.*

head or sides of a metacarpal, metatarsal, or phalangeal bone, which is common to it and another digit (Fig. 141). (3) A fully-developed organ may have its own metacarpal or metatarsal and phalangeal bones distinct. (4) There may be a more or less developed organ intimately united along its whole length to another digit, and having either an additional metacarpal or metatarsal bone of its own, or articulating with the head of one which is common to it and the other digit.

The number of these additional fingers and toes is usually one, but there may be two or more. As many as nine toes on one foot have been reported.[1] In the treatment of supernumerary digits the same rule does not apply alike to the hand and foot. In the hand they are not only a deformity, which patients insist shall be removed, but they may interfere materially with its functions. In the foot, on the contrary, the question of deformity is rarely considered, while the function of the foot may not be at all impaired. Each case must therefore be studied by itself, and a course of treatment adopted especially applicable to the conditions existing as regards function and deformity.

The first variety of supernumerary digit should be removed at an early period, whether in the hand or foot. The pedicle is readily severed, the vessels ligated, and the wound may be closed with a suture or two. In the second variety the attachment of the digit is much larger and more care is required in its removal. In addition to this, the extra digit may have a common articulation with the normal one, and in its removal the joint of the latter becomes involved in the operation. If the digit has a single articulation of its own, it must be removed with the knife by making flaps which, when united, will leave the least possible cicatrix. If the removal involves another joint, we need not now be deterred from the operation, as the joint, though opened, can be protected by antiseptics.

The third variety of deformity may or may not require to be remedied. If the position of the digit is such as not to be a decided deformity, nor to interfere with the function of the other digits, it may be better not to remove it. Otherwise, amputation should be performed. In its removal the entire digit should be taken away, with such formation of flaps as will leave the least noticeable cicatrix.

In the fourth variety we have a union of digits in such manner that the deformity may be slight or considerable, and the treatment must vary accordingly. If the supernumerary finger is bound to the other close throughout, so as not to be webbed, it must be left undisturbed or be completely dissected out of its place. If it is separated so as to form an attachment by a well-defined web, the web may be separated as will be described, and the digit allowed to remain as an independent organ.

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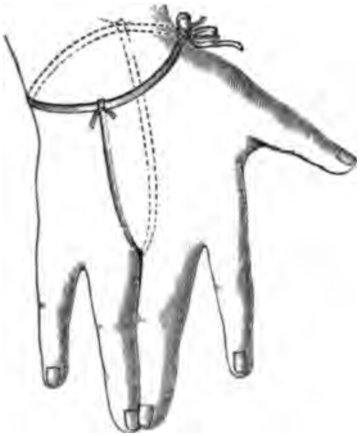
[1] Johnstone: *Tr. Path. Soc. Lond.*, vol. ix. p. 427.

CONGENITAL UNION OF THE FINGERS AND TOES.

There are three varieties of this deformity.[1] Two or more digits may be united (1) by loose folds of skin only, the true webbed condition; (2) by a more intimate connection of the skin and deeper soft textures; (3) by the union or fusion of the bones as well as the soft textures. The union may be confined to a portion only of the extent of the digits, or it may extend their whole length.

In the treatment of this deformity it may be stated that, as a rule, no operation is useful when it occurs in the foot. In the first variety, as found in the hand, the webbed fingers must be separated. The web may attach only the ends of the fingers, in which case the operation consists simply in separating the integument uniting them and treating the wound left upon each finger. If the union extends the entire length of the fingers, a very different procedure is required, owing to the inevitable contraction of the wound, especially at the angle between the fingers. There are two methods deserving of trial. The first consists in making a permanent opening in the web at the angle of the fingers by means of a seton (Fig. 142). When the opening has so far healed that there is no liability to closure, the remaining portion of the web may be divided and the wounds healed. The seton consists of an india-rubber cord of the size of a No. 8 catheter, which is passed through a canula previously carried through the web with its trocar in position. The ends of the rubber cord are to be fastened to a band around the wrist. When the opening has so far healed at its margins that it will not close, the remaining web is divided and the wounds treated for rapid union.

FIG. 142.



Seton Inserted.

FIG. 143.

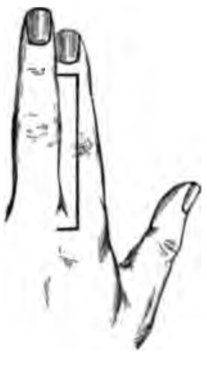
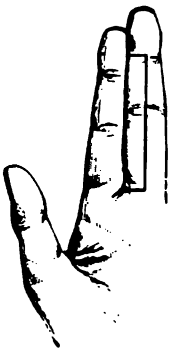


Diagram of Flaps in Operation.

FIG. 144.



Webbed Finger, with Thick Septum.

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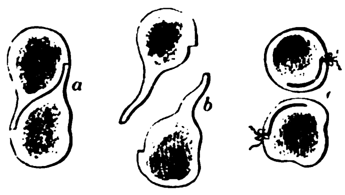
[1] Allingham: *op. cit.*

The second method is especially applicable to cases in which the web is thick and firm. It is as follows: Two flaps of the web are made, an anterior and a posterior, but reversed (Figs. 143, 144). For the posterior make an incision along the dorsal aspect of one finger the length of the web, and transverse incisions at either extremity to the middle of the dorsum of the other finger. These incisions are to be repeated on the palmar surface, but the longitudinal incision must be repeated along the palmar surface of the finger which forms the base of the posterior flap. The two flaps thus formed are now dissected and turned backward. The two fingers should next be separated, and they will be found to have each a flap, one attached upon the dorsal and the other upon the palmar surface (Fig. 145). The flaps are next to be applied to their respective fingers; with the union of these flaps the fingers are effectually and permanently separated.

FIG. 145.



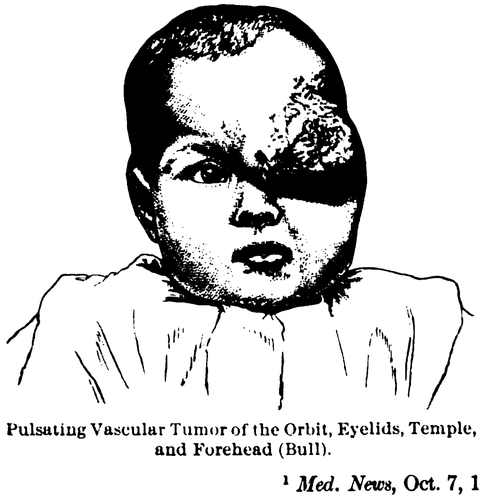
Operation for Webbed Finger: *a*, the lines of the two incisions uniting, so as to divide the web and leave a flap on each side; *b*, the flaps detached from the opposite finger to those to which they are adherent; *c*, the flaps applied to the fingers, and covering in the raw and exposed surfaces.

CEPHALHÆMATOMA.

For a description of this condition see page 678.

The treatment of cephalhæmatoma should be conservative. In the great majority of cases absorption takes place. If, however, the disease remains, the cavity should be freely opened, all of the blood carefully removed, dead tissues and granulations cut or scraped away, the internal surfaces cleansed with weak carbolic solutions, a drainage-tube introduced, and the wound accurately closed and dressed with antiseptic materials.

FIG. 146.



Pulsating Vascular Tumor of the Orbit, Eyelids, Temple, and Forehead (Bull).

PULSATING VASCULAR TUMOR OF ORBIT.

Dr. C. S. Bull of New York reported[1] a case of pulsating vascular tumor of the orbit treated by electrolysis, with partial success. The child was about seven months old, and the tumor involved the eyelids, temple, and forehead. There were four applications when the child was lost sight of, but the hardening and condensation increased steadily as long as it was under observation.

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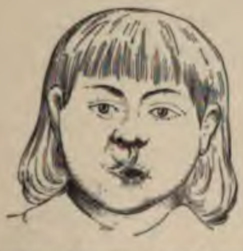
[1] *Med. News*, Oct. 7, 1882.

ATRESIA ORIS.

Atresia oris is a congenital closure of the mouth by a membrane, and is allied to imperforate anus. There may also be an acquired closure due to the cicatrization of burns. If the narrowing is very great at birth, it is called microstoma congenitum. In either case the treatment consists in enlarging the mouth by dilatation or by a formal operation. Dilatation is adapted to cases in which the tissues are yielding without much pressure. The fingers may be used to stretch the angles, at first singly, and finally two fingers.

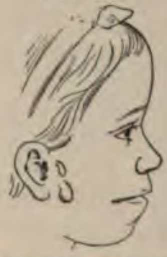
If the mouth is narrowed by cicatricial tissues, or if the parts are dense and unyielding, an operation must be undertaken. Lateral incisions should be made to the proper extent, and then the margins of the lips should be so shaped that the mucous membrane gives a longer flap than the skin; the former must then be turned over and attached to the latter very accurately, so as to secure immediate union. If the two margins are adjusted so as to secure union, the operation will be permanently useful. If there is a tendency to contract, dilatation must be resorted to and persisted in for a considerable period.

FIG. 147.



Cicatricial Contraction of Mouth.

FIG. 148.



Large Mouth, Pendulous Growth near Ear.

A child may have a malformation of the mouth quite the opposite of the preceding—viz. an enlargement, macrostoma congenitum. In this case the angles of the mouth are extended backward toward the angles of the lower jaw. The defect is due to an arrest of the process of union between the maxillary process and the first branchial arch. Or the defect may extend upward and backward toward the angle of the eye.

Treatment is most successful when the defect is the result of failure of union and there is no deficiency of tissue. The operation consists in preparing the opposing edges by dissection, so that two fresh surfaces may be placed in accurate apposition. Hair-lip pins will generally be necessary to maintain the two portions of the cheek in proper apposition until union takes place. If there is much deficiency of tissue, a plastic operation may be devised which will meet the indications.

HARE-LIP.

Hare-lip is a congenital defect of the upper lip. The lip is formed by the union of three portions—one central, connected with the intermaxillary bones (Fig. 149), and two lateral, connected with the submaxillary bones. If union fail upon one side, there is a single hare-lip; if on both sides, the hare-lip is double. The cleft corresponds with the junction of the intermaxillary bones when it is central—a very rare defect—or with the intermaxillary and the maxillary bones when it is lateral. The cleft may be a slight cicatrix (Fig. 150), or a mere notch (Fig. 151), or it may involve the entire lip (Fig. 152), or it may be double (Fig. 153), or, finally, it may be complicated with a more or less extensive non-union of the bones (Fig. 154). In some cases there is a double hare-lip with non-union of the intermaxillary bones, which seriously complicates the defect (Fig. 155).

FIG. 149.

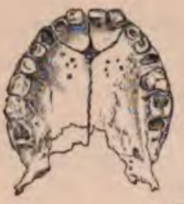


FIG. 150.

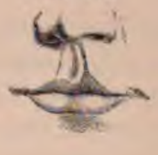


FIG. 151.

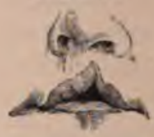


FIG. 152.

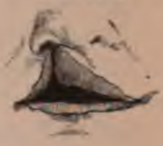


Fig. 149.—Showing Development of the Intermaxillary.
Fig. 150.—Hare-Lip, congenital cicatrix.
Fig. 151.—Hare-Lip as a slight notch.
Fig. 152.—Hare-Lip as deep fissure in right side.

FIG. 154.

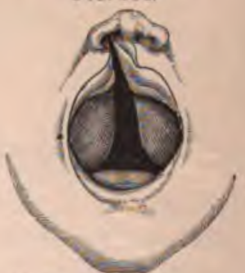


FIG. 153.

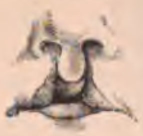


FIG. 155.

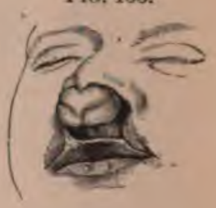


Fig. 153.—Uncomplicated Double Hare-Lip.
Fig. 154.—Fissure of Hard and Soft Palate.
Fig. 155.—Hare-Lip complicated with Fissure of Alveolus and Projection of Intermaxillary Bone, the palate being perfect.

The period of operating is important. If the infant is robust and the hare-lip simple, the operation may safely be performed immediately. Unless, however, there is special urgency, it is better to delay for several days, even in the simplest form of hare-lip. If the child is feeble, the operation should be delayed until the third or fourth month. If we are governed by the mortality after the operation, we should fix the period of least danger at from three to six months. In cases where the infant cannot take food easily, an early operation may be a necessity if all of the conditions are favorable. If the case is one of double hare-lip or is complicated with clefts of the hard palate, it is better to wait until the child is two or three years old, unless the difficulty of taking food renders an immediate operation necessary. The operation should never be attempted while the child is suffering from any disturbing cause, as diarrhœa or an eruptive disease.

If the operation is delayed from any cause, great care should be taken to secure proper nourishment of the child. In general, infants suffering from hare-lip, except in the slightest form, are not well nourished. They are liable to be feeble, have little endurance, and in some instances emaciate and die of exhaustion. The mother's milk is the best if she is in health, and the infant should be supplied with it, even if it must first be drawn from the breast with a pump and then fed to the child.

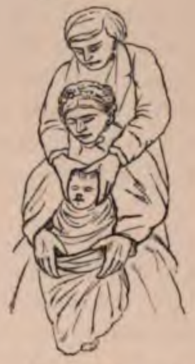
The operation should be planned with great care and executed with deliberation. The rule of sacrificing as little tissue as possible should always govern, whatever may be the method of procedure selected. With a little study of each case it will often be found practicable to modify to advantage the stereotyped form of operation, and especially to save tissues, which should not be sacrificed.

In very young infants it is not advisable to administer an anæsthetic. The child can be readily held by assistants, and it is well to avoid the depressing effects of the drug. If the child is a year or two old, chloroform should be employed.

If the patient is an infant, the best position in which it can be placed is sitting in the lap of the nurse. It should first be wrapped in a sheet, so that its arms are well secured, and then be firmly held by an experienced assistant, while its head is well supported by a second assistant (Figs. 156, 157). If the child is two or three years old and takes chloroform, it is better to wrap it in a sheet and lay it on a suitable table. The table should be placed in a good light, and all of the arrangements made for an antiseptic operation. If the patient lies on a table, the operator may stand at the head.

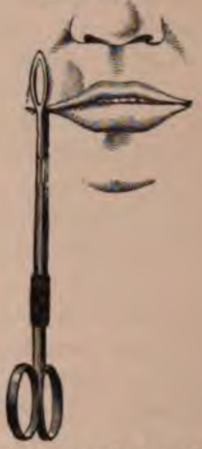
It is important to prevent the loss of blood during the operation, for, unless precautions are taken beforehand, there is liable to be a flow from the cut surfaces which does not attract attention until a dangerous amount of blood is lost. The thumbs and fingers of an assistant grasping the lip on either side of the cleft are usually the most reliable agents for compressing the vessels. If an assistant cannot be relied on, ring forceps may be used as compressors, the handles being controlled by a rubber ring, and the degree of compression by the position of the rubber ring.

FIG. 156.



Operation for Hare-Lip, position for infant.

FIG. 157.

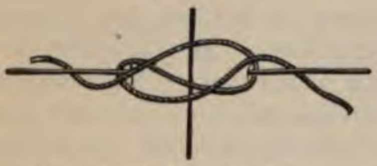


Elastic Compressor applied over Coronary Artery.

Whatever may be the method of operating, the first step should be to free the lip from all attachments, so that the flaps will move freely. To effect this object, the lip should be raised and put on the stretch. By this act the attachments of the mucous membrane are seen, and they should be incised at their reflection from the lip to the gum, so as to admit of the freest movement of the sides of the cleft. The closure of the wound must be by the hare-lip pin, unless the case is one in which there is no strain or considerable tension. This pin should be of steel, very fine, and of sufficient length to leave projecting on each side an inch to an inch and a half of the shaft. It should be entered at least one-third of an inch from the margin of the cleft, and be carried obliquely through the flap to the margin of the mucous membrane, but not through it. The needle should next traverse the wound, enter the margin of the mucous membrane of the opposite side, and then pass through the flap, emerging at a point at the same distance from the margin of the cleft as it entered on the opposite side. The mucous membrane is not punctured. The two flaps are now nicely adjusted, and a silk thread passed around so as to form a figure-of-eight (Fig. 158). If two pins are used the turns of the thread may include both (Fig. 159).

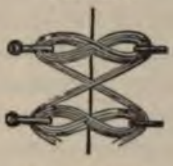
Additional sutures should be employed to secure the margins of the wound. The best material is horse-hair softened, though fine silver wire answers a good purpose. A sufficient number should be used to accurately adjust the wound, but at the border especial care must be taken to apply the sutures, so as to give exactness to the flaps. It is necessary also when completing the sutures to evert the lip gently, and if there is a point where the wound is gaping posteriorly, one or more sutures should be inserted: this prevents irritation of the wound by saliva or food. The ends of the pin or pins should now be cut off with sharp snippers, and a piece of lint placed under the end of each, so as to prevent its penetrating the skin when straps are applied.

FIG. 158.



Application of Twisted Suture.

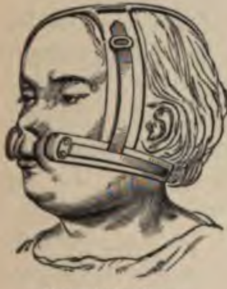
FIG. 159.



Twisted Suture.

After the sutures are adjusted the two flaps must be well supported, either by a truss (a very convenient appliance) or by straps. The truss (Fig. 160) brings the cheeks well forward, and leaves the wound open for examination.

FIG. 160.



Hainsby's Truss.

If straps are employed, they should be the adhesive rubber plaster, cut so as to have one broad end for the cheek and a narrow portion over the lip to the opposite cheek. Two of these applied, the wide part to the opposite cheeks, are sufficient. The cheeks should be drawn well forward before the narrow portion is laid over the lip, in order to relieve all tension on the wound. The pin should not be covered.

To avoid the scar of the pin, it should be removed within forty-eight hours. On attempting its removal seize one end with forceps and slightly rotate it, so as to loosen its connections: then withdraw it, while with the other hand the parts are maintained firmly.

If the case has progressed favorably, the dressing should be very carefully removed. For this purpose warm bichloride solution, 1 : 2000, should be employed. The dressings should, as far as possible, be removed without any force, by wetting with the solution. If at any point union has failed, care must be taken to support the flaps in proper contact in order to secure union by granulations. Good results may be obtained by securing such union when the failure of immediate union extends throughout a considerable portion of the wound.

During the period required for the operation the child must be well nourished by feeding. The mother's milk should be taken from the breast artificially and fed to it. An œsophageal tube has been used for feeding. In about one week, if the case has done well, the child may be allowed to begin nursing.

Fissure of the lip, the simplest form of cleft, requires a method of operating quite different from other forms. In this case there is no necessity of cutting away any part of the cleft. On the contrary, the material is so scant as to make it desirable to increase the tissue. This is ingeniously accomplished by Nélaton's operation. Two incisions are made through the whole thickness of the lip which meet at a point above the tip of the fissure, and extend laterally parallel with the sides of the fissure (Fig. 161). The extent of these lateral incisions should be governed by the depth of the fissure. They should not involve the free margin at any point, but should leave two substantial flaps. The double flap thus formed is then depressed, the former apex of the cleft presenting downward, while the open wound assumes a diamond shape (Fig. 162). The wound should be closed by a single hare-lip pin passed through the widest part of the wound, now the angles formed by the depression of the double flap. When the wound is closed the apex of the flap projects considerably beyond the natural margin of the lip. This projecting tip of marginal tissue, though quite unsightly at first, gradually contracts, and as the cicatrix undergoes the ordinary changes in the process of complete repair the margin of the lip becomes even, with little or no appearance of deformity. If any projecting mass remains, after two or three years, which is unsightly, it may be removed by a slight operation.

FIG. 161.

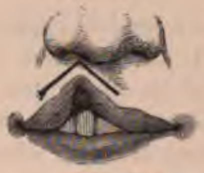
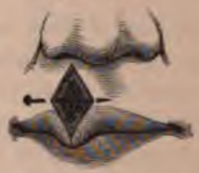


FIG. 162.

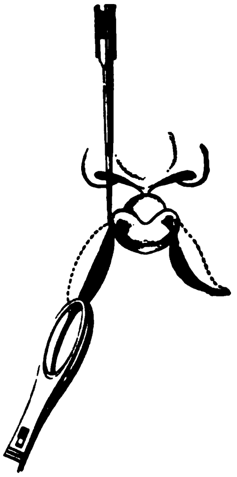


Nélaton's Operation for Partial Hare-Lip.

Single hare-lip may occur on either side, and may vary in extent, involving but a part or the entire depth of the lip. In the selection of the method of operating the aim should be not only to secure well-adjusted flaps, but to avoid a depression at the point of union at the margin of the lip. By some methods the depression of the lip at this point becomes a decided deformity which must afterward be remedied.

Several methods have been practised to accomplish that purpose. The first and usual method is the old operation, which consists in cutting away a portion of each flap by curved incisions, with the concavity toward the fissure. The lip is seized with fine-toothed forceps at the lower edge of the cleft, and the part is put on the stretch. With a narrow knife the flap is transfixed above, and a curved incision is made downward, first along the external and then along the internal cleft (Fig. 163). On uniting these flaps the margin of the lip protrudes at their junction, thus avoiding a cleft or depression. Nélaton's operation is best adapted to clefts that do not involve the entire lip into the nostril. The result of this operation on a complete cleft is seen in Fig. 164. The simple operation of Malgaigne effects the same object. The incision is carried along the fissure until it reaches the red border, when it is turned rather abruptly toward the cleft. This method saves some of the border of the lip, and when the flaps are united creates a projection at the point of union at the border (Fig. 165). The operation of Collis in large single clefts is on the principle of saving the "parings" as far as possible. This operation is performed as follows: Make an incision from *A* to *B* (Fig. 166) through the thickness of the lip, down to the mucous membrane, but not through it, and turn the flap back. On the opposite side transfix the lip at *C*, and separate a flap as far as *D*, dividing it at *E*. The two sides are now brought together; the flap *CE* is turned upward and the point *E* is attached to *A* by a suture.

FIG. 163.



Operation for Double Hare-lip. Right side of lip drawn down by spring-hook forceps; long narrow knife entered at angle; dotted line shows direction of the incisions.

FIG. 164.

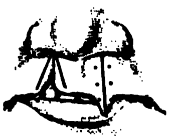


FIG. 165.

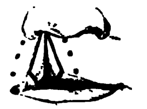


FIG. 166.

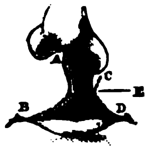


FIG. 167.

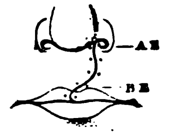


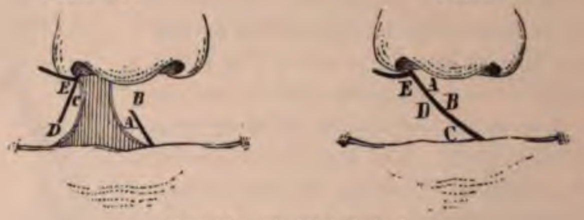
Fig. 164.—Malgaigne's Operation for Hare-Lip.
Fig. 165.—Operation for Single Hare-Lip.
Figs. 166 and 167.—Collis' Operation for Hare-Lip.

The flap *ED* is turned downward, and the point *E* is attached by suture to *B*. Two or three intermediate sutures should be applied. The effect of this operation is to prevent the slight notch by the flap *ED*, to form a mucous surface for the nostril by the flap *EB*, and, finally, by turning the flap *AB* backward, to double the thickness of the cicatrix. The result is seen in Fig. 167.

If the cleft is symmetrical, an operation resembling that known as Nélaton's may be performed (Fig. 161). It is, however, especially adapted to cases where the cleft does not pass into the cavity of the nostril.

If the cleft is very large, the method of Giraldès will probably give the best results (Fig. 168). The flaps *C* and *A* are made on either side, so as to save all tissue. The incision on the right side extends from *E* to *D*, and that on the left side from *B* to and including the margin of the lip. An additional incision is made from *E* upward and outward under the nose. The union of these flaps is seen in Fig. 169.

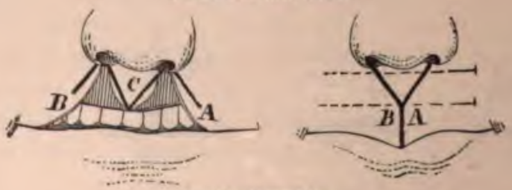
FIG. 168. FIG. 169.



Hare-Lip: Giraldès' Method.

Double hare-lip may exist without fissure of the hard parts (Fig. 170). In this case the method of operating should be such as will tend to obliterate any central cleft. If the traction on the flaps should be great, the operation should be divided into two parts, one side being operated upon and allowed to recover before the other is undertaken. Operate thus (Figs. 170, 171): The flaps being loosened, make the incisions *A* and *B* from above downward and outward through the entire thickness of the lip. At the upper ends the flaps are cut loose, but at the lower extremities the incisions terminate two-thirds of the distance from the borders of the lip. The central portion is next incised on both sides, but as little tissue is sacrificed as possible. The two lateral flaps are then turned downward and united at *BA*. By this union of flaps the prepared surface of the lateral edges

FIGS. 170 and 171.



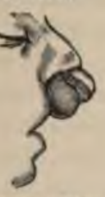
Double Hare-Lip.

of the cleft are brought into contact with the incised edges of the central portion. One or two pins are necessary to secure good coaptation of the upper portions of the wound. The remainder is easily united with sutures.

The most difficult cases of hare-lip in treatment are those complicated with a non-union of the intermaxillary bone. The question always arises as to the propriety of saving the projecting mass of bone. As a rule, this bone can and should be saved. But there are cases when it is better to remove the bone, as when it is very much out of position and the child is feeble, or when it is simply a pendulous mass attached to the tip of the nose. In the slighter cases of projection of the intermaxillary bone it may only be necessary to fracture its attachment to the septum and press the mass backward into position. If the bone is too large to fill the space, the lateral surfaces must be cut away sufficiently and the adjacent sides of the superior maxillary bones refreshed.

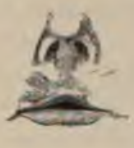
A wedge-shaped piece may be cut from the septum, which will allow the mass to recede more readily into the cleft. In order to retain the bone in place, sutures have been applied to the sides of the notch; also silver sutures have been passed through it and the adjoining hard palate, but several teeth were destroyed by the destruction of their sacs; again, the bone has been held in position by at once uniting the clefts in the soft tissues. If the flaps are insufficient to close the space, they may be so far dissected from the cheek as to admit of their easy approximation. The operation may be divided into stages, dealing first with the projecting intermaxillary bone, and subsequently with the soft parts.

FIG. 172.



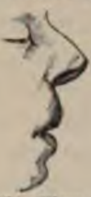
Before Operation.

FIG. 173.



Front View.

FIG. 174.



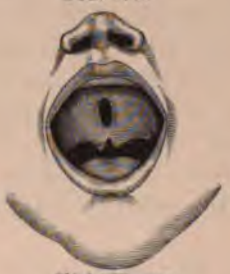
Side View
after Operation.

If the mass is of such a nature as to render it desirable to remove it altogether, as when it is simply suspended from the tip of the nose, it should be carefully dissected away with scissors, retaining the soft parts in such form as to make a columna nasi or to fill the gap in the lip. The result is often very satisfactory.

Fissured Palate.

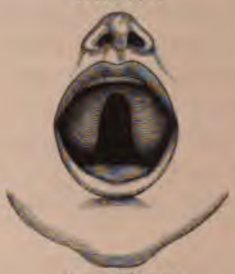
Congenital defects of the palate are very variable in extent. The intermaxillary bones may alone be separated, or the fissure may be at one or two points in the roof of the mouth, or the cleft may involve only the uvula (Fig. 175), or the fissure may involve the soft and hard palate; or, finally, the fissure may extend throughout both the hard and soft palates. The conditions are the same in all cases—viz. a failure of the physiological process of fusion of the bones or soft parts of the opposite sides at the points of natural junction.

Fig. 175.



Slight Fissure.

Fig. 176.



Large Fissure.

The most serious result of these clefts, when extensive, is the difficulty the infant experiences in nursing. A complete fissure of the soft palate and uvula even may render the act of sucking very imperfect. The act is rendered more difficult when the fissure extends through the hard palate. It is of the first importance, therefore, to attend early to this defect as to taking food and to the child's nutrition. The tendency is to the escape of the food through the nose if the child succeeds in drawing milk from the breast or while it is being fed with a bottle or spoon. In some cases the deficiency is so great that fluids pass into the trachea, as in the instance reported by Dewees, where the child strangled severely on every attempt to take fluids. This defect can be remedied to some extent by placing the patient in a nearly upright position while it is taking food. The milk then passes into the pharynx more readily, and is at once swallowed. The child with fissure of the hard palate will take food from a bottle more easily if it is supplied with a large india-rubber nipple. By studying the peculiarities of nursing and feeding in each case many expedients for overcoming the defects will be suggested. Holmes[1] mentions a case where he admitted a child to the hospital for the operation. The parents alleged that the infant was rapidly failing from loss of nutriment, as they could not feed him without all of the fluid running out of his nose. It was found that this difficulty was due only to the awkwardness of the parents, and that under the skilful care of the hospital nurses the child throve perfectly well.

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[1] *Surg. Treatment of Children's Diseases.*

In addition to the care necessary to proper nutrition by feeding, the health of the infant must be promoted by such hygienic measures and remedies as the case demands.

The age at which the operation should be performed must depend upon the extent of the cleft and upon its effect on the child's nutrition. If the operation were simple and ordinarily successful, an early closure of these clefts should be the rule, for it is very desirable that this obstacle to feeding, and subsequently to speech, should be overcome at the earliest possible period. But the operation is difficult and tedious, and its success depends upon conditions of health not easily secured for these subjects. There is liability to free hemorrhage, and hence to shock which has resulted in convulsion and death. The tissues are also tender, and do not admit of much strain on the sutures. As a rule, therefore, it is better to defer the operation until the third or fourth year, or even later in life.

Hypertrophy of the Alveolar Process.

Hypertrophy of the alveolar process appears as a congenital affection, and consists of an expanded and prolonged development of the alveolar borders of the maxillæ, immense thickening of the fibrous tissue of the gum, and exuberant growth of the papillary surface. When fully developed the patient presents an extraordinary appearance: a large mass, dense, inelastic, insensitive, pink, and smooth, protrudes from the mouth.

Absence of the Tongue.

Absence of the tongue is a very rare defect. In its place appears one or two nodules which are movable. No method has been devised of remedying the defect.

The tongue is occasionally bifid, either at the point or the split may extend backward nearly to the root of the organ. The defect is not due to a failure of two parts to unite, as in clefts of the palate, for the two halves of the tongue spring from a common centre, and not from two centres. It is alleged by Ahlfeld that in its simplest form the cleft is due to the traction of a too short frænum. The defect does not interfere with the functions of the tongue to such an extent as to make an operation necessary. If, however, an operation is desired to relieve the deformity, it may be undertaken with every prospect of success. The procedure consists in removing the opposed surfaces of the cleft, and then uniting them with suture. The hemorrhage must be controlled by ligature of any bleeding vessel; union takes place promptly.

The tongue may be adherent to the floor of the mouth. The adhesions are usually at the sides of the tongue or immediately beneath it, and consist of folds of mucous membrane. There may be but two or three, or they may extend from the tip around each side, completely binding the tongue down, or the adhesions may extend from the tongue to the lower jaw. The functions of the organ are very much interfered with, and an operation is necessary. The division of the bands must be accomplished by incision, all bleeding being promptly arrested by ligature; or, if there are but one or two bands and the child is feeble, a ligature may be passed around each and be left to separate by ulceration.

TONGUE-TIE.

Tongue-tie is of very infrequent occurrence. The popular belief in this defect is very common, and mothers often urge physicians to operate upon children in whom there is no disability. But it should always be a matter of duty to examine every case where it is alleged that the infant does not nurse properly, for tongue-tie may exist, and relief can only be obtained by a timely operation. It may be accepted as a rule that the operation is not required when the tip of the tongue can be protruded beyond the edge of the gum, or in case the finger can be passed under the tip and elevate it. It is due either to the unusual breadth of the frænum or to the extent of its attachment forward at the extremity of the organ. The effect of this condition of the frænum is seen when an effort is made to protrude the organ or to suck. The end of the tongue is firmly held down behind the alveolar process, while the dorsum is elevated instead of forming a groove, as is necessary in the act of sucking.

The operation of dividing the frænum is best performed by passing the tips of the first and second fingers of the left hand, palms downward, under the tongue and on either side of the frænum, and raising the tongue toward the roof of the mouth: by this act the frænum is put on the stretch. With blunt-pointed scissors the edge should be snipped, and such further division may be made as will give sufficient freedom to the tongue. A cut to the depth of an eighth of an inch is ordinarily sufficient. The danger in the operation is hemorrhage from a wound of one of the arteries, but these vessels are protected by the fingers placed as described.

MACROGLOSSIA.

Macroglossia, or hypertrophy of the tongue, is usually a congenital affection or appears in early infancy (Fig. 177). Butlin[1] states that "in many cases in which the disease has occurred in young subjects it has followed so closely on various general and local maladies, and has appeared so clearly to owe its origin to them, that the theory of congenital origin can scarcely be maintained successfully for every case." It has been attributed to such local causes as abscess, ranula, mercurial salivation, injuries, and it has been immediately preceded by such constitutional causes as chicken-pox, scarlet fever, whooping cough, and epileptic attacks. The above author suggests that in such cases there may have been an inherited predisposition in some, if not many, of the patients.

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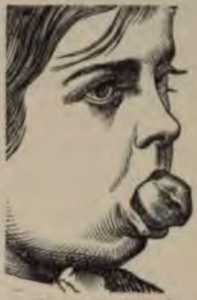
[1] *Diseases of the Tongue*, p. 211.

Fig. 177.



Hypertrophy of Tongue.

In regard to the pathology of macroglossia, Virchow first discovered that there was dilatation of the lymph-vessels, with an increase of the connective tissue. Butlin[1] states that most authors are agreed that the diseased condition of the lymphatics is the essential element in macroglossia, and that all other changes which are observed are secondary to this. The enlargement of the blood-vessels is quite secondary in importance, and may be accounted for by the greater supply of blood which is needed for the nourishment of the hypertrophied organ.

The diagnosis in the earlier stages, while the tongue is confined to the mouth, is difficult. The organ may appear to be larger than normal, but if it does not increase in size a decided opinion could not be given. If the tongue steadily enlarges and begins to protrude from the mouth, the symptoms become more and more characteristic. The mouth remains open or is closed with difficulty; the saliva flows freely from its angles, food is swallowed with difficulty and may require to be forced back with the finger, the tongue becomes dry, and may finally fissure and ulcerate. The affection is chronic in its course, and may require years for its complete development.

Treatment is very successful, and should be early resorted to and persistently employed. In the early stages compression and astringents have proved useful. If the tongue can be maintained in the mouth, the compression of the walls of the cavity can be utilized. In this case the mouth should, as much of the time as possible, be kept firmly closed by a bandage. If the tongue protrude from the mouth, Syme's method may be employed—viz. apply lint moistened with a solution of cupric sulph. ℈j, aq. ℥j, and bandage firmly. If these means fail, the proper treatment is excision.

VASCULAR TUMOR OF THE TONGUE.

Angeioma occasionally appear on the dorsum of the tongue of infants.

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[1] *Op. cit.*, 207.

They are more often venous in their structure than arterial. They may be single or multiple. They are composed of numerous anastomosing vessels or they may have a cavernous structure.

They are generally situated on the anterior part of the dorsum, and project slightly above the surface. The mucous membrane becomes thin over them, and has a dull-blue or livid appearance. The mass feels tense and elastic, like a thin cyst filled with fluid. They are usually quite painless, and are seldom very large or inconvenient, except from their tendency to bleed and occasional bulk. Their life-history varies: they may disappear altogether, without leaving any trace of their former existence, or they may gradually increase in size, so as to become troublesome by interfering with eating and speech; or they may undergo warty degeneration.

The treatment should be destruction of the vascular character of the growth by the actual or galvano-cautery, the latter being preferable. If the actual cautery is used, the needles should be brought to a dull-red heat and then thrust deeply into the tumor. This operation should be repeated until the mass is thoroughly subjected to the cautery. With the galvano-cautery a dull-red heat is very easily maintained after the metal point has reached the interior of the tumor; and hence this cautery is much more readily managed, as the single point may be moved about in the interior of the growth until the entire mass is subjected to its influence.

INTESTINAL OBSTRUCTION.

Various forms of intestinal obstruction may occur in childhood.

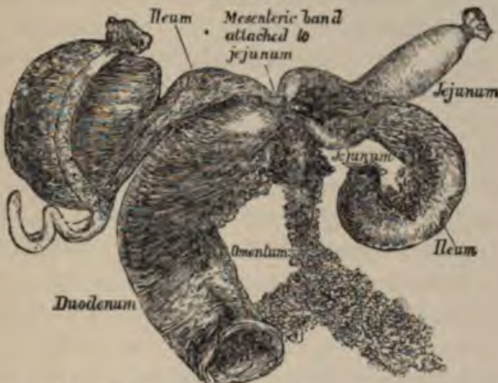
Ileus or twisting of the bowel upon itself is sometimes met with, the cause of which is unknown. The bowel may be obstructed by bands or adhesions which are the result of a former local peritonitis. In these cases we occasionally find a loop of intestine which had passed under the band and then became strangulated; or a diverticulum may have existed which by its adhesions created a band, under which the bowel passed and became fixed.

Intussusception or invagination of the intestines is the most frequent cause of obstruction. There are many causes of invagination, such as spasmodic action of the bowel from irritants, the presence of a polypus, diarrhœa, etc.

The diagnosis of the exact nature of the cause of obstruction is generally impossible, and the surgeon must approximately discriminate as to the cause by a careful study of the symptoms.

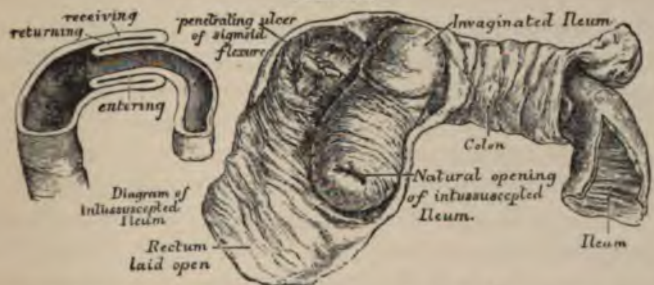
It may be stated, as a general rule, that obstruction caused by adhesions has a more or less chronic course as compared with obstruction by intussusception or a twist. In the former case the child suffers from frequent attacks of abdominal pain, sluggish action of the bowels, indigestion with vomiting. As the constriction increases the bowels become distended, emaciation increases, and the presence of a hard mass may be detected through the abdominal walls, or if the obstruction is at the rectum, the left iliac region may be filled with feces.

FIG. 178.



Case of Strangulation of the Bowel by Lymph-band constricting ileum about three inches from cæcum, and a coil of jejunum.[1]

FIG. 179.


receiving
returning
entering
penetrating ulcer of sigmoid flexure
Invaginated Ileum
Colon
Natural opening of intussuscepted Ileum.
Diagram of intussuscepted ileum
Rectum laid open
Ileum

Intussusception, with diagram showing the entering, returning, and receiving layers of ileum into colon.

Strangulation of the small intestines may be caused by peritoneal false ligaments, by the omentum and mesentery, by slits and holes in different organs, by diverticula, by the appendix vermiformis, by internal hernia, and by twisting, knotting and compression (Fig. 178).[1]

Strangulation by band[2] occurs, with scarcely an exception, in the small intestines, and the segment involved is in the great majority of cases the lower part of the ileum: this is due to its relation to the cæcum and appendix, its descent into the pelvis, and the presence of a diverticulum.

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[1] T. Bryant.

[2] F. Treves.

In occlusion of the jejunum, collapse, vomiting, and anuria usually appear early and soon reach a considerable height; the course is usually rapid, the meteorism inconsiderable, limited to the epigastrium, or entirely wanting, and the abdominal wall even retracted; the vomited matter is stained with bile greatly discolored, but never feculent; when the occlusion is of the lower part of the ileum, the meteorism is noteworthy, sometimes limited mainly to the meso- and hypogastrium, with comparative hollowness of the regions corresponding to the colon: the course is also rapid, collapse, vomiting, and suppression of urine appearing early, but the vomited matters soon become feculent.[1] These cases are rarely relieved by any other treatment than laparotomy. The gentlest efforts may be made by kneading the abdomen. If this fail, the operation should be performed. If bands are found, they should be tied with catgut ligature, and then divided or excised; if the bowel is twisted, it should be replaced, and, to prevent the twist recurring, sutures[2] may be passed through the mesentery of the bowel and the parietal peritoneum of the left abdominal wall.

Intussusception of the jejunum and ileum may occur in the infant.[3] Owing to the comparative narrowness of the tube into which the invaginated portion of the bowel descends, strangulation and congestion are speedy and intense, and sloughing and separation of the strangulated part are consequently most frequent (Fig. 179).[4] It follows that this intussusception generally runs an acute course; impermeability is immediate and permanent, and death may follow in from three to six days, with or without peritonitis or perforation; in other cases the invaginated portion sloughs, either in strips and shreds or in tubular sections, between the eleventh and twenty-first days.[5] The general symptoms of intussusception combine a variable degree of obstruction and inflammation; the patient manifests signs of sudden, violent pain, sometimes distinctly recognized as a straining sensation, rarely accompanied by rigors; vomiting follows, which may subside if the inflammation is early and intense, but more frequently continues and becomes stercoraceous in the course of three or four days. The infant may become convulsed. The tumor caused by the intussusception is a physical sign of the greatest value; though of small size in many cases, especially in the earlier stages, and often obscured by the distension of the intestine, yet a careful examination will usually detect its presence.

The most characteristic features of intussusception of the small intestines are the violence of the symptoms, the rapid progress of the disease, more copious hemorrhage from the bowels, blood sometimes in the vomited matters, more complete obstruction, the discharges containing little or no fecal matters, the absence of tenesmus, the tumor small and situated within the abdomen and in the right hypogastrium.[1] Sloughing and discharge of the invaginated portion occasionally occur, followed by recovery. The question of reducing the invagination demands early consideration, and must be determined with due regard to the fatality of the disease, the possibility of recovery in each individual case, with or without sloughing of the invaginated portion, and the fact that rough, forcible, ill-timed proceedings will do more harm than good.

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[1] O. Leichtenstern.

[2] Roser.

[3] J. L. Smith. [I have seen a fatal case at the third month.—Ed.]

[4] J. S. Bristowe.

[5] O. Leichtenstern.

Prof. Nothnagel[2] has published some interesting experiments on ligature of the intestine of animals, which throw some light on the action of the bowel after strangulation. The effect of the ligature upon peristalsis varies according to whether it is applied to a quiescent portion of intestine or to one in which a peristaltic wave is already in progress. In the former it does not give rise to tempestuous peristalsis; in the latter it does. When the ligature is tight enough to cause effectual obstruction, violent peristalsis sets in in the portion above the constriction, the contents are forced down against the stricture, and the bowel just above the ligature becomes over-distended, and at length paretic, but no antiperistalsis is observed. Fecal vomiting is accounted for by the fact that it is in the direction of the stomach that the least resistance is encountered.

The prognosis of obstruction from whatever cause is always very grave. Whatever may be the cause, the affection usually runs a rapid course, and if relief is not prompt serious complications follow, as peritonitis, rupture of the bowel, sloughing of the constricted part. It is a fact, however, that the most serious cases occasionally recover. The obstructing mass in the bowel may become dislodged, the loop of constricted intestine may slip out of its false position, and the invaginated portion of bowel may slough off and be discharged.

The treatment of obstruction of the bowels in infants requires great discretion, in which caution and yet promptness are duly combined. The patient cannot bear too active treatment, and still delay is likely to prove fatal. The most important step to be taken is in the diagnosis. If the nature and location of the obstruction are correctly made out, the course of treatment becomes at once evident; but if these features of the case remain obscure, the treatment must be involved in doubt and uncertainty.

In regard to medication, it is evident from Nothnagel's experiments that the indications point to measures capable of soothing the irritation and calming the intensified peristaltic action. Purgatives should be avoided; no food should be taken; opium should be given in large doses, preferably in the form of the crude drug, but if that is not well borne by the stomach, morphine may be used subcutaneously. Warm salt-water enemata are useful. Belladonna, mercury, nicotine, and electricity have not proved serviceable.

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[1] W. Brinton.

[2] *N. Y. Med. Journ.*, April 13, 1889.

In conducting the treatment of a case diagnosed as intussusception of the small intestines, it must be borne in mind that reduction can be easily made only at an early period, before the adhesions have become firm. It is important, therefore, to lose no time in employing the more simple methods. If these fail to relieve, the surgeon should resort to abdominal section. Laparotomy has these advantages—viz. 1, the intussusception may be relieved by traction; 2, the involved bowel may be resected; 3, the bowel may be opened and attached to the wound, forming an artificial anus. It may be undertaken at the earliest age, having proved successful in the infant of six months; but it is important that it should be performed as early as practicable, for success depends largely upon the condition of the bowel; and when the strangulation is tight, the parts speedily become so altered by swelling, adhesion, and softening that no amount of force short of that liable to cause rupture will suffice to liberate them.[1]

Intussusception at the ileo-cæcal valve assumes two principal forms: (1) ileo-colic, the passage of the ileum through the ileo-cæcal valve; (2) ileo-cæcal, the passage of the ileum and cæcum into the colon: the former is very rare, the latter the most common, especially in childhood and during the first year.

These invaginations more often run a chronic course, and are distinguished from those of the small intestines as follows: by the tenesmus, which is rarely present in any marked degree where the small intestine only is implicated; by the greater size and fixation and different site of the sausage-like tumor, which, if large, generally occupies the left side of the hypogastric or left iliac region; by the hemorrhage, which instead of being copious is little more than a scanty admixture, scarcely sufficient to tinge the mucus passed from the bowels with violent and frequent straining; by the degree of obstruction, which seems to be really absent, owing to the patulous state of the axis of invagination; by the presence in the more marked and protracted cases of the invagination in the rectum.[2]

The tumor is rarely discovered in the region of the cæcum, owing to its small size, want of firmness, and its rapid progress along the colon, rendered easy by the great mobility of the cæcum; nor is it easily detected when it occupies either colic flexure, particularly the right, where it will be overlaid by the liver; more often it is found along the course of the descending colon as an elongated swelling somewhat movable from side to side, frequently becoming harder and more prominent during a paroxysm of pain; the finger in the rectum may detect the tumor and define the ileo-cæcal valve, and if the other hand meantime is applied to the abdomen, the continuity of the rectal and abdominal tumor may be determined (Fig. 180).

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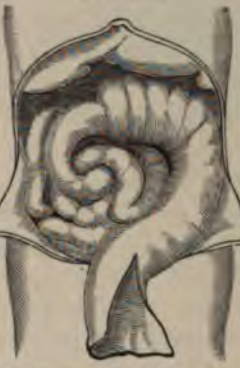
[1] H. B. Sands.

[2] W. Brinton.

FIG. 180.



Intussusception of Cæcum.

The post-mortem appearances of fatal ileo-cæcal intussusception were as follows (Fig. 180): The descending colon was enormously enlarged and full; the sigmoid flexure was distended and made a great curve nearly to the right side of the abdomen; the distended transverse colon, thrown into transverse folds, could be traced to the right side of the median line; the ileum, cæcum, and ascending colon were entirely intruded and pushed into the descending colon, descending into the rectum within a few inches of the anus: on opening the rectum and sigmoid flexure the termination of the intussuscepted portion was found to be almost black, the apex very tense, and its opening marked by a fissure caused by a contraction of the mesentery: turning aside the bowel, it was found to be convex and twisted from the dragging of the mesentery, and at the concave side was a large irregular ulcer at the most tense portion; there was general peritonitis, due to perforation of an ulcer in the sigmoid flexure.

The treatment is the same as ileum invagination, to which is added injections of air and water. The distension of the lower bowel must be carried to the fullest extent short of rupture, and should be undertaken early, before adhesions have formed: if water is used, place the child on the lap of the nurse; elevate the hips forty-five degrees, to secure the aid of gravitation; provide lukewarm water, and with the common bulbous syringe—or, better, the fountain syringe—inject it gently until the abdomen is somewhat distended; now carry the finger gently but firmly over the abdominal walls along the direction of the colon, in order to force the liquid upward against the intussusception; if the water is discharged, the injection may be several times repeated. If water fail, inflation may be resorted to, which produces a more equable and effective distension; the common bellows with a tube is efficient; or carbonic acid gas may be employed as obtained from bottles charged with the gas in the shops; by inversion a powerful current may be conducted through the tube of a rubber syringe.

The amount of distending pressure which it is safe to apply to the bowel in employing water is fixed in the infant at eight or nine pounds.[1] The fountain syringe is considered the only one that can be used in these cases with accuracy, and therefore it is the only one that should be employed; by it the amount of force used can be accurately measured, as every two and a half feet in height of the reservoir above the point of delivery represents about one pound pressure on every square inch of the intestine below the point of obstruction; if the reservoir is suspended seven and a half feet above the child, a force of three pounds to the square inch is exerted on the obstruction; the rubber tube being fifteen feet in length and vertical, the pressure will be six pounds to the square inch; with a tube of sufficient length any pressure can be brought to bear on the tumor as desired. It will be accurate enough for all practical purposes to estimate that a column of water two and a half feet high exerts at its base in every direction a pressure of one pound to the square inch; hence the exact force used in giving an injection can be obtained in this manner. The only important feature about the siphon syringe is the long tube or a number of pieces of rubber tubing that can be spliced. A glass vaginal syringe with a shoulder one inch from the end will be found a very important adjunct: by this simple contrivance an injection may be given without fear of wounding the intestine, without making painful pressure on the parts about the anus, without the escape of a drop of the liquid used, and with the utmost ease and convenience to the operator; its effectiveness is due to the fact that during the terrible expulsive efforts of the patient the stretched sphincter is supported by the large tube and the shoulder, and thus none of the liquid used can escape. The danger of using the common bulb-syringe is seen in the fact that with the hand a force of ninety pounds can be brought to bear upon the column of water.

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[1] W. E. Forest.

The operation of laparotomy in this form of invagination should be undertaken as a last resort, but the delay should not be so great as to endanger the integrity of the bowel.

THE RECTUM.

This bowel commences at the left sacro-iliac articulation, and is directed at first obliquely downward and from left to right, to gain the middle line of the sacrum; it then changes its direction and curves forward in front of the lower part of the sacrum and the coccyx; it then turns backward and downward to the anus. At its upper end it is narrower than the sigmoid flexure, but above the anus it is dilated into a large ampulla or reservoir.

The rectum is developed from the internal blastodermic layer. The development begins at the upper part of this bowel, and as it progresses the rectum descends into the pelvis until it reaches a cul-de-sac which has for its external opening the anus. The continuity of the passage from the rectum to the anus is effected by the absorption of the intervening tissue.

The affections of the rectum in infants which require the care of the surgeon are the result of its imperfect or irregular development. The bowel may descend properly, and yet a very thin partition between it and the anal cul-de-sac may remain unabsorbed; or it may be arrested at any point in its descent; or it may make abnormal openings into the bladder or vagina.

Imperforate rectum exists when there remains a partition between the rectum and the anal cul-de-sac still unabsorbed at the birth of the child. The symptoms are those of retention of the meconium, followed by abdominal distension and vomiting.

On examination with the finger or an elastic catheter or bougie the occluding membrane will be discovered. If the membrane is thin, there will be noticed a bulging of the septum when the child cries, and a decided impulse against the tip of the finger if it is employed in exploration.

If there is no marked distension of the rectum and the symptoms are not pressing, the operation may be delayed for two or three days to allow the lower bowel to become well filled with meconium. If the occluding membrance is very thin, it may be possible to break it down with the finger. If it is too dense for rupture by this method, it must be punctured and then incised. The puncture should be made with a sharp-pointed bistoury, the blade being wrapped with thread to near the point. The finger or a director should be used as a guide, the patient being held in the position for lithotomy. The direction of the puncture must be accurately determined, so that it may not deviate from the normal direction of the calibre of the bowel. The appearance of meconium is evidence of penetration through the septum into the cavity of the rectum. The opening should be enlarged by crucial incisions, and the passage then distended by the end of the finger or by a bougie of suitable size. The subsequent treatment consists in repeatedly distending the strictured part for several months.

Absence of the rectum may be partial—which is more common—or complete, the anus being normal in either case. When it is only partially absent, the other portion usually terminates in a cul-de-sac at a greater or less distance from the surface of the body, or it may be prolonged as a narrow tube or imperforate cord, and blended with adjacent parts. The rectum may be absent, and only be represented by a narrow canal which terminates in some abnormal situation.

The diagnosis of the exact condition of the malformation is impossible. With the finger or with a bougie the presence of the rectum can often be satisfactorily determined, and when present the comparative degree of the thickness of the intervening tissues may be decided. But if the rectum is wholly or partially absent, only a careful dissection can reveal the nature of the changes from the normal which exist.

The operation must be conducted in the manner already described.

If the rectum is found, it must be brought down if possible, opened, and attached by the margins to the integument. If the rectum is wholly absent, as proved by a careful dissection, the last resort must be a second operation, for establishing an artificial anus.

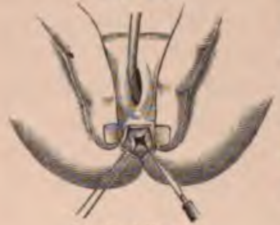
Vaginal and vesical fistulas, through which the malformed rectum sometimes discharges its contents externally, are complications which must, as far as possible, be relieved.

The vaginal fistula may exist with the rectum perfectly formed and continuous as a separate canal nearly to the anus. Here it may be occluded by tissues more or less thick, and have a fistulous communication with the vagina. Or the rectum may terminate in a cul-de-sac opposite, or even somewhat above, the required opening. The opening into the vagina varies in size and situation, being generally a short distance up the canal, but in some cases it has been near the os uteri.

The purpose of the operation is twofold—viz. first, to secure and maintain the opening of the bowel at the natural site of the anus; and second, to close the unnatural opening into the vagina.

If the rectum continues past the vaginal opening down to or nearly to the site of the natural anus, introduce a curved probe into the vaginal opening, and make it protrude the skin of the perineum at the proper place. An incision should now be made down upon the end of the probe to the intestine, the bowel opened, and the mucous membrane brought down and attached to the external wound, if it can be sufficiently detached from the surrounding tissues.

FIG. 181.



Vaginal Fistula.

In case the rectum does not continue down to the perineum, but ends in a cul-de-sac higher up near the vaginal opening, the dissection must be continued upward until the rectum is reached. After opening it an effort should be made to bring the mucous membrane down to the external wound. If this method of securing the continuity of the bowel with the anus is found impracticable, the wound must be kept open by rolls of antiseptic gauze repeated for several days, and by distension with the finger or a bougie for a long period.

On establishing a new outlet through which the feces freely escape, the fistula tends to close. If, however, it remain open, it should be treated as an ordinary fistula by irritating injections, as of iodine, or it may be incised.

A vesical fistula is recognized by the character of the urine. It is thick and of a greenish appearance at the time of the movement of the bowels, and there is often an escape of gases with the urine. The relation of the rectum to the bladder varies much in different cases. In some the bowel terminates in the bladder directly after its passage out of the false pelvis, and in others it descends nearly to the perineum, and communicates with the bladder by a small fistulous passage. The relief of these cases by operation depends upon the development of the rectum. If it has descended, well formed, nearly to the perineum, the operation already described of cutting down to the bowel and attaching it to the external wound will succeed. But if the rectum terminates high up in the pelvis, and especially if it is imperfectly developed, an operation will probably fail of giving any relief. Fistulous passages to the rectum may be found opening at many other points, but the principles of treatment are the same as those given for vaginal and vesical fistulæ.

Absence of both rectum and anus is rare, but when it exists there is a dense fibrous tissue occupying their normal positions. The absence of the rectum cannot be diagnosed except by an exploratory operation, as with a grooved needle, or by a careful dissection. Before exploring the part there should be a sufficient delay to allow of the accumulation of matters in the rectum. If the needle is used, place the infant on the back with the thighs well flexed on the abdomen. Insert the needle cautiously, bearing in mind the proper position of the rectum along the curve of the sacrum and nearly in its centre. If a dissection is made, the patient should be held in the position given, and the first incision should be made where the anus is located and an inch or more in extent. The dissection should be cautiously made along the curve of the coccyx and sacrum, the finger being used in the wound as a guide. The wound being held well apart by retractors, the exploration should continue a finger's depth if the bowel is not discovered. If it is found, the treatment is the same as that already given.

If it appears on exploration that there is an absence of the rectum, or if the operation through the perineum fail to give relief, there is no other resource but to open the colon and form an artificial anus at the point of operation. Colotomy may be performed in either groin or in the loin, but recent experience proves that left inguinal colotomy should be preferred. The value of this operation in the adult has been demonstrated by Mr. Allingham, who has systematized the details and rendered it simple and comparatively safe in adults. It is better adapted to children than other methods of relieving the distended bowels. The final success of this, as of other operations for the same purpose, is not encouraging. Mr. Edmund Owen[1] has operated six times on infants with immediate relief, but not with permanent success. The operation is as follows:[2] The abdomen should be cleansed with soap and water, and everything used in and about the wound should be aseptic. An incision is made, about two inches in length, an inch within the anterior superior spine, and crossing an imaginary line drawn from the anterior superior spine to the umbilicus. In making this incision the skin should be drawn a little inward, so that the opening through the transversalis fascia and the peritoneum is on a different level when the skin is relaxed, thus making the opening valvular and rendering its subsequent closure with a pad easier. The peritoneum being reached, it is pinched up and a small opening made, which is subsequently enlarged to nearly the length of the cutaneous incision. The small intestine generally first presents, but on pushing it back the colon often shows itself: if it does not, it can readily be found by passing the finger downward into the pelvis, and following the rectum upward till the sigmoid flexure is reached; which can be hooked out with the tip of the finger. A loop of bowel being drawn into the wound, two provisional silk ligatures are passed through a portion of the peritoneal coat opposite the mesenteric attachment. These provisional ligatures help to steady the bowel during subsequent stitching to the skin. They should be an inch or more apart. The bowel is now returned to the cavity, and the parietal peritoneum is picked up with forceps and attached to the skin on each side of the incision by two or three sutures of fine silk. The bowel is again drawn out by means of the provisional ligatures, and fixed to the skin by four or five fine sutures. These sutures are passed by fine partly curved needles, passing first through the skin an eighth of an inch from the margin, then through the parietal layer of the peritoneum, and lastly through the peritoneal and muscular coat of the bowel, care being taken to avoid perforation of the mucous membrane. It is better to pass all of the sutures before tying any. A suture should now be passed through the skin and the peritoneal layer of the bowel at each end of the wound. It is desirable to pass the sutures not far from the mesenteric attachment of the bowel, so that about two-thirds of it is external to the wound. The wound is now dressed with antiseptic appliances, the immediate covering of the wound being a piece of green protective to prevent adherence to the part. The dressing should be reapplied on the next day to make sure that nothing has been displaced. On the fifth or sixth day the union will be firm, and the opening of the bowel may be made directly between the two provisional ligatures.

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[1] *Surg. Dis. Children.*

[2] Mr. Cripps: *Brit. Med. Journ.*, Oct. 6, 1888.

If the distension is very great at the time of the operation, and it may be deemed necessary to open the bowel at once for relief, an assistant must compress the bowel above and below the place of incision to prevent the escape of matters while the edges of the wound are being stitched to the skin.

Polypus of the rectum is occasionally met with, and it may be very soft or of considerable density. It usually creates irritation of the rectum and bladder, causing painful efforts to evacuate the bowels.

These efforts are attended with the passage of blood from the bowels, and sometimes the tumor may appear slightly externally. It usually has a pedicle, which may be gradually lengthened by the pressure of the feces during the straining efforts of the child. The symptoms of vesical calculus may be present, and unless the surgeon is thorough in his examination he may be entirely deceived as to the source of the trouble.

Exploration of the rectum should always be made when defecation in a child is painful, with the passage of blood, and no other cause is apparent. The spasm may be so great on attempting exploration that an anæsthetic must be given.

Removal is the proper remedy. It will sometimes happen that the tumor will be dislodged by the finger during the examination. It will be necessary to dilate the anus generally, pull down the tumor, and ligate the pedicle.

THE ANUS.

The anus is the lower opening or extremity of the alimentary canal. It is surrounded internally by mucous membrane and externally by the skin. These membrames here become continuous and pass into each other. The lower end of the rectum and the margin of the anus are embraced by the internal and external sphincter muscles, and supported by the levatores ani. The anus is therefore a dilatable orifice.

In all operations upon the anus its peculiar function as the outlet of the intestine, with power of voluntary closure through the action of the muscles mentioned, should be borne in mind. Impairment of these muscles by operative procedures can often be avoided if the surgeon exercises good judgment and proper care, when, otherwise, their functions might be destroyed, and a lifelong disability of a most distressing character entailed.

The affections of the anus in infants requiring surgical care and treatment are congenital defects.

An important duty of an accoucheur, too often neglected, is to examine the newborn as to any defects about the anus. If closure of the anal aperture is not discovered until the nurse has given the child a laxative, as occasionally happens, great suffering may attend the useless efforts at evacuation. When closure exists the infant may be allowed to nurse moderately until relieved by an operation, for, although vomiting may be a marked feature in the act of digestion, yet sufficient nourishment may be received to maintain the strength of the child for a considerable period. But when the defect is made out an early operation for its relief is necessary.

Contraction of the anus is the simplest congenital defect. The anus may alone be involved or the narrowing may extend also into the rectum. The form and situation of the anus are generally normal, but the orifice is puckered or plicated: the narrowing may be slight or it may only admit a probe. The symptoms are retention of meconium, vomiting, and progressive painful tension of the abdomen. The treatment is dilatation carefully conducted to overcome the induration of the integument about the anus. If the narrowing is not great, the dilatation should be begun with a graduated bougie and completed with the finger. The tip of the bougie should be of a size to readily pass the strictured part. If there are feces in the rectum, move the bowels with an enema. If no enema is required, a little oil should be injected to lubricate the passage. The best position for the patient is on the back, with the thighs well flexed. The bougie should first be dipped in hot water, to render it soft and pliable, and should then be well oiled. It should be passed gently but firmly into the constriction, the direction of the rectum with reference to the opening of the anus being duly regarded. The operation should be repeated daily until the normal calibre at least has been secured. When the dilatation has reached a point which makes it possible to substitute the little finger for the bougie, it is better to use the finger.

If the narrowing is extreme and the parts are very rigid and unyielding, the constriction must be relieved in part by incision. The knife, however, should not be employed unless efforts at dilatation fail, as incisions are liable to be followed by firm contractions, unless great pains are taken to keep the passage well dilated. The first incisions should be on either side in the direction of the tuber ischii. The depth and extent of these incisions must depend upon the relief afforded. They should be of such depth that feces are evacuated, but the sphincter should be incised as slightly as possible. If the first incisions prove too slight, they should be cautiously repeated. The bougie should at once follow making the incisions, but the pressure should at first be moderate. The bougie or finger should be disinfected with carbolized oil before using it when incisions have been made.

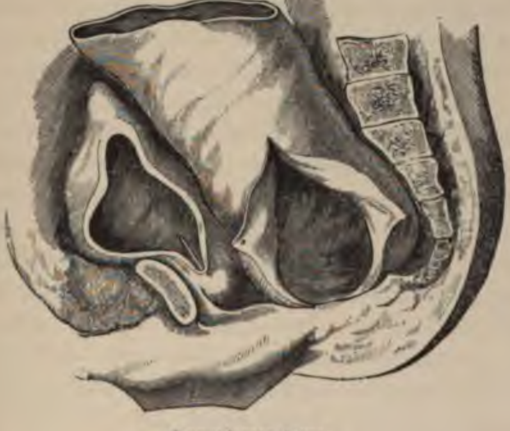
The anus may be slightly occluded by an extension of the integument partially over the orifice. When this membrane exists it should be freely incised and broken up by the bougie or finger.

Imperforate anus exists when the anal aperture is completely covered by a membrane. This tissue may be very thin, so that the meconium may be seen distending it, or it may be so thick and unyielding as to resemble very closely the skin. The diagnosis is readily made. If the membrane is thin, it appears as a small bluish mass in the situation of the anus, which is enlarged by distension with the meconium when the child cries. If the membrane is thick, there will still be the tumor, which will become tense when the child cries. With the finger the anal space may be readily detected, and on pressure the tumor will recede, but will again immediately become prominent on withdrawing the finger.

In the treatment it is to be borne in mind that the structures forming the anus and rectum are normal, and that the treatment should aim only to remove the obstruction offered by the membrane. The operation consists of a puncture of the centre of the membrane, and from this point the making of a crucial incision, one portion running antero-posteriorly, and the other laterally. The puncture should be made at the dark point in the membrane which indicates the centre of the anus. The incisions should be made with a probe-pointed bistoury. The immediate effect of the operation is the discharge of the accumulated meconium and relief of the most distressing symptons. If the membrane is very thin, the flaps formed by the crucial incision may be left to disappear by absorption, or they may be removed by scissors. If the membrane is thick, the flaps or angles should be excised. The first dressing should consist of the introduction of a pledget of absorbent cotton covered with carbolized oil and held in place by a bandage. This dressing should be removed whenever the bowels move for several days. On the removal of the dressings the anus may be usefully dilated with the finger well oiled.

Absence of the anus is characterized by the obliteration of every trace of the orifice (Fig. 182). The perineal raphé extends from the scrotum to the point of the coccyx without interruption, and the space of the anus is occupied with cellulo-fibrous tissue. But behind this membrane is the rectum, fully formed and filled with meconium. The defect is not in the development of the rectum, but of the anus.

FIG. 182.



Imperforate Anus.

If the rectum is near the perineum, fluctuation may sometimes be detected by the finger in the perineum or by pushing up in the direction of the rectum while with the left hand firm pressure is made upon the anterior walls of the abdomen inward and downward toward the finger in the perineum. If the rectum is near the external surface the finger will detect its presence.

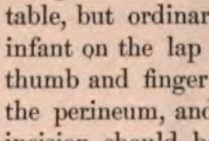
It has been stated by Mr. A. C. Hutchinson that gentle titillation of the skin with the finger over the natural situation of the anus will cause the child to strain to evacuate the bowels, and thus produce a protrusion of the distended rectum, provided it is low in the pelvis.

The prognosis in these cases is very favorable. If the rectum descends nearly to the perineum, the case is one which admits of relief with much certainty.

Before proceeding with the operation the surgeon should determine, as nearly as possible, the exact site of the anus. In general, the sphincter muscles exist in a more or less complete state, and it is desirable to preserve their functions about the new-formed anus. To effect this purpose the location of the anus should be fixed, and the operation should be conducted with a view to restoring its functions. In some cases it will be found useful to introduce a small sound through the urethra to the bladder to determine its position and its relations to the rectum. If it deviate in such manner as to indicate malposition of the organs of the pelvis, the sound should be used during the operation.

The details of the operation are largely those of exploration, and care should be taken to employ all necessary antiseptic measures. The best position of the child is that for lithotomy. It may be placed on a table, but ordinarily an assistant or a competent nurse can secure the infant on the lap so as to give good light and prevent motion. The thumb and finger of the left hand should be placed on either side of the perineum, and the central portion put on the stretch. The first incision should be exactly in the median line from a point near the scrotum to the extremity of the coccyx (Fig. 183). The incision should be repeated, but the length limited, the deepest portion of the wound being at the point where the anus is believed to be located. This part of the wound should be frequently examined with the point of the finger to ascertain by fluctuation the presence of the blind sac of the rectum, and also the position of the bladder or vagina. If the dissection is made strictly in the median line there will be no danger of hemorrhage from wounds of large vessels, but any considerable deviation laterally is dangerous.

FIG. 183.

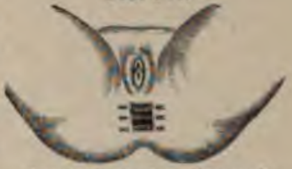


Incision for Imperforate Anus.

If the rectum is not found in the middle line, search should be made posteriorly, as the extremity is sometimes displaced from the centre.

The bowel will be recognized by its dark-brown color, its elasticity, and its evident fluctuation. It is important to avoid opening the bowel if it is found to be near the anal opening. In order to preserve the cleanliness of the wound, the proper course is to detach the rectum and draw the portion presenting down with forceps until it lies in the external wound. The finger is generally most useful in separating the bowel, but the scissors or knife may be required. When the bowel is well exposed, it should be opened and the contents thoroughly evacuated. The exposed portion should now be thoroughly cleansed, and the margins of the wound of the bowel should be accurately united to the integument by six sutures (Fig. 184). The end of the rectum should occupy the exact situation, so far as it can be determined, of the undeveloped anus. The mucous membrane should not be included in the suture, but should be allowed to overlap the integument, to prevent the wound being soiled by the discharges. The remaining portions of the wound, anteriorly and posteriorly, should be closed and antiseptic dressings applied.

FIG. 184.



Band attached to External Wound.

The child should have its legs bound so as to prevent strain of the wound. The wound must be carefully watched to prevent soiling, and the dressings should be such that they may be readily renewed.

It may be found impossible to loosen the attachments of the bowel so as to bring it down to the margin of the external wound. In that case the bowel must be opened in its first position by a longitudinal incision, and there be allowed to remain. In the final perfection of this wound care must be taken to maintain the opening free by passing graduated bougies.

Abnormal anus is characterized by the existence of fistulous openings through which fecal matters are discharged at unusual points, the normal anus being occluded or rudimentary or absent. The rectum may terminate in one or several sinuses, which open in the perineum, or beneath the urethra, or at the vulva, or in the sacral region.

If the canal or canals are direct and of considerable size, the infant thrives for a time, owing to the ready escape of the semifluid contents of the rectum. But when the feces become more consistent the escape is difficult, and relief by operation is imperative.

The indications are to establish an anal opening at the proper point and separate the fistulous passages from the rectum. If the anus is merely occluded by a membrane, this should be divided, as already described, and the passage of fecal matter from the rectum made direct. The fistula should be closed by incising it or by passing through it a silk ligature by which its walls are destroyed, or a rubber band may be passed and by frequent tightening made to cut its way out.

If there are two fistulæ near together at the anus, it will merely be necessary to divide the septum and thus establish a free outlet.

When there is no trace of an anus the operation performed must resemble the one already described for that malformation. The fistulous passages may be useful guides to the rectum. The dissection should be cautiously made in the direction of the normal course of the rectum. When the bowel is reached, it should, if possible, be brought down to the external wound and sutured, while the sinuous passages should be divided and treated with a view to their closure.

HYDROCEPHALUS.

Congenital hydrocephalus is an effusion into the ventricles of the brain. The bones of the cranium being ununited, they readily yield to the pressure within, and the increasing fluid gradually unfolds the convolutions. While the base undergoes but little if any change, the frontal, parietal, and occipital bones are expanded and become much thinner. The hemispheres are spread out in thin laminæ on either side, decreasing in thickness from the base to the vertex. The membranes do not undergo any change except what is due to distension. The effusion is caused by a chronic inflammation of the lining membrane of the ventricles and of the arachnoid. The prognosis is always very unfavorable.

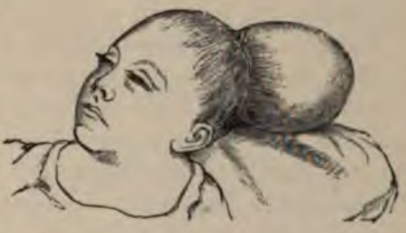
The cure of the affection depends upon the subsidence of the inflammation. As this cannot be treated directly, only temporizing measures can be pursued. Two methods of treatment have been adopted to overcome the accumulation of fluid—viz. compression and tapping. Compression should be employed as follows: Cut strips of adhesive or rubber plaster one-third of an inch in width; apply first a strip from each mastoid process to the outer part of the orbit of the opposite side; then from the back of the neck apply a strip along the longitudinal sinus to the root of the nose. Then strips are to be applied over the whole head, so arranged that they cross at the vertex. The dressing is completed by passing a long strip around the head three times just above the ears and eyebrows and below the occipital protuberance. The dressing should not be too tight, lest convulsions should be excited. If the health of the child continues good and the compression is well tolerated, the cap must be continued. If, however, there is an increase of the fluid and convulsions seem to threaten, the straps must be loosened or removed altogether.

If tapping is indicated, select a small aspirating-needle, or a small trocar if the aspirator is not used. Thoroughly cleanse and disinfect the part of the scalp where the puncture is to be made. Then, holding the needle or trocar perpendicularly, insert it at the edge of the anterior fontanelle, to avoid the longitudinal sinus and the large veins emptying into it. The fluid should be withdrawn very slowly, and moderate external compression should be carefully maintained by the hands of an assistant or by a bandage. Not more than two or three ounces should be withdrawn at one sitting. If during the operation the pulse becomes weak or the dilated pupils contract or there are signs of convulsions, the needle or canula must be withdrawn and the puncture closed with adhesive plaster, previously treated with disinfected water.

The tapping should be repeated, if the symptoms are favorable, in three or four days.

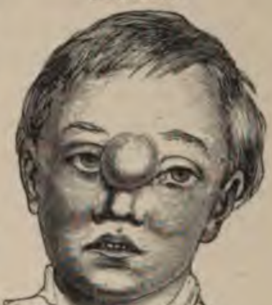
Meningocele consists of a protrusion of the meninges of the brain by an accumulation of fluid within the cranium of the newborn infant. The tumor appears at one of the fœtal openings of the bones, and is caused by a pre-existing hydrocephalus. The ordinary situation is in the occipital region (Fig. 185) where the tumor protrudes through the expanded portion of the occipital bone, behind the foramen magnum, and in the median line. The tumor may appear at other points, especially at either fontanelle and at the root of the nose (Fig. 186). It may appear at the sides of the skull, where the bones are joined, at the inner angle of the orbit, above the orbital arch, in the temporal region, at the base of the skull, communicating with the deep parts of the face. The tumor may be a single sac or it may have numerous septa; it may be sessile or may have a pedicle; it may be translucent like a hydrocele and enlarge when the child cries, or it may be reducible. The nature of the tumor may be recognized by these appearances and by its being congenital.

FIG. 185.



Meningocele.

FIG. 186.



Meningocele at the Root of Nose.

In treatment the danger lies in the relations of the meninges and brain to the tumor. Care must therefore be taken from the first to avoid exciting inflammation of these tissues. Irritating external applications are not only useless to effect a cure, but may prove very harmful. On the contrary, the tumor should be supported and protected in such manner as to make gentle pressure. A bandage may be used or a cap protected with cotton-wool to prevent ulceration, as gutta-percha lined with layers of wadding which can be increased in thickness as the tumor yields to pressure. If the tumor increases in size without other symptoms, puncture may be resorted to. Care must be taken to cleanse the surface of the tumor with soap and water and disinfectants, and the needles must first be placed in carbolized water. The dressings after the puncture must be aseptic.

If the tumor has a pedicle, so as to separate it in some degree from the cranial cavity, injections of iodine—ʒij, with equal parts of water—may be employed, some of the fluid having first been removed. Noble[1] reports a case cured by the injection of a preparation of ten grains of iodine and thirty of iodide of potassium in an ounce of glycerin. Of this fluid eight-minim doses were injected into the wall of the sac, not into the cavity, for the purpose of affecting the lining membrane. The injection was frequently repeated until the cure was complete.

Excision is the radical method of treatment. It may be performed without hesitation when the communication between the contents of the tumor and the brain has been obliterated. If there is an opening into the cranial cavity, the operation may still be successfully performed, but the most rigid care must be taken that antiseptic measures be thoroughly employed. If there is no opening, the excision is performed as for any simple tumor. If an opening exists, bichloride solution should be used during operation. A clamp may first be applied to the pedicle. Flaps should be made of the skin of sufficient size to cover the wound without tension. In closing the wound the deeper structures may first be united by catgut sutures, and then the skin flaps should be brought together accurately. A catgut drain should be inserted at the lower angle of the wound. Bichloride gauze should be applied and maintained by a bandage.

Encephalocele resembles a meningocele, but its contents consist of a protruding portion of brain or of brain and dropsical membranes. It appears at the various openings of the skull, and may be sessile or pedunculated. It is recognized as a congenital tumor after pulsating, and is generally small and flat. It is most difficult of diagnosis when seated at the root of the nose, in the course of the frontal suture, or near one of the angles of the orbit, as it resembles sebaceous or other tumors. In cases of doubt the effects of pressure must be noted, and the examination should be several times repeated. As a final method of determining its nature, a disinfected exploring-needle may be employed. The principle of treatment is the same as that of meningocele, but radical measures, as excision, must be very cautiously undertaken and with all necessary antiseptic precautions. These tumors are closely allied, and differ essentially only as to their contents. Meningocele is a tumor covered with the membranes of the brain, and containing fluid, while in an encephalocele the contents consist of brain-substance. They occur as protrusions of the contents of the cranial cavity, and may exist at birth (congenital) or may appear soon after birth (acquired). The brain escapes at an aperture of the skull or at a perforation of the bone. The tumor may appear in the occipital or frontal region, and is more frequently in the median line. When it occurs posteriorly the brain escapes through an opening near the middle line of the occipital bone. In anterior encephalocele (*procencephalocele*) the tumor appears at the root of the nose, more often at the junction of the frontal and nasal bones. Encephalocele may occur through a division of the cervical vertebræ.

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[1] *Lancet*, 1884.

Protrusion of the brain may be met with in the temporal and in the parietal regions, or the tumor may enter the orbit through the sphenoidal fissure and force the eyeball forward, or it may appear in the mouth through the spheno-maxillary fossa.

The tumor is double in some instances, but more often when it is situated at the internal angle of the eye.

The appearance is that of rounded tumors, semi-transparent, generally slightly fluctuating; the skin is natural, and if there is pulsation it is synchronous with that of the heart. When located, dissection shows that the coverings of the tumor consists of skin, fascia, cellular tissue, and the aponeurosis, and the contents of dura mater, arachnoid, and the brain-tissue. The arachnoid usually supplies the fluid, which sometimes contains spermatozoids.

Cephalhydrocele.—This affection is a subfascial accumulation of the cerebro-spinal fluid, due to a simple fracture of the vault. Prof. O'Conner[1] of Cincinnati reports two cases which occurred in his own practice, and refers to twenty additional cases of this comparatively rare accident. It is a very serious disease, owing to the liability of the patient to meningo-encephalitis and abscess. Even in those who recover there has been a subsequent morbid mental condition, indicated by irritability of temper.

The diagnosis of the nature of the affection must rest upon an examination of the fluid of the tumor. Pulsation was absent in about half of the cases. When there is evident pulsation synchronous with the heart-beat, and a normal-colored but thin scalp-covering, so that translucency is observable; when increased fulness is apparent on crying or holding the breath; when upon pressure a diminution of volume is readily effected, with or without resulting symptoms of cerebral irritation,—the diagnosis is clear, and should be made at once. But under opposite conditions, where there is no pulsation, no translucency, no recognition of a cranial gap,—nothing but the withdrawal of a fluid in appearance and chemical constitution similar to the cerebro-spinal fluid will determine the existence of a traumatic cephalhydrocele.

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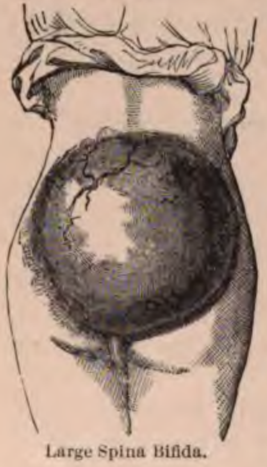
[1] *Transact. Am. Surg. Asso.*, vol. ii.

The treatment employed has availed little toward effecting a cure by closure of the fracture. Removal of the fluid by aspiration is only palliative.

SPINA BIFIDA.

Spina bifida (Fig. 187) is a defect in the bones of the spinal column which admits the protrusion of the membrane in the form of a hernia; it is of the same nature as a meningocele, and contains subarachnoid fluid, and often nerve-trunks, and even the spinal cord itself; hydrocephalus often exists at the same time. The defect may exist at any point in the column, cervical, dorsal, lumbar, or sacral, but the lumbo-sacral form is most frequent; the tumor may have a broad or very narrow base, and directly open into the spinal canal or be quite disconnected; its covering may be quite thick, or so thin as to be transparent, or ulcerated so as to allow the escape of its contents; it is usually quite tense when the child is awake and erect. In general, this affection proves fatal, sometimes owing to the defective organization of the child, in other cases from convulsions or an inflammation following an opening of the sac. No case of spina bifida ought ever to be subjected to any active operative interference, except in the most urgent circumstances, and the mildest measure which affords any rational prospect of cure should be the one selected. It may be treated by punctures with needles and compression, the punctures being at the side to avoid nervous tissue, or it may be repeatedly punctured, the fluid withdrawn, followed by strong compression. Injections of iodine may be used, as follows: Draw off several ounces, then inject five grains of iodine and fifteen grains of iodide of potassium dissolved in an ounce of water; after a few seconds allow this fluid to flow out, wash the sac with water, and inject two ounces of the original cerebro-spinal fluid. Pressure around the neck of the sac may be made to bring the internal surfaces in contact and secure adhesions, and thus shut off the cavity of the tumor from the spinal canal and admit of its excision. Excision has been successful when there was no nervous tissue in the sac and the pedicle was small, after applying a clamp several days and thus

FIG. 187.

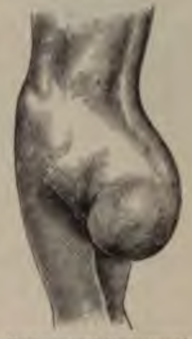


Large Spina Bifida.

exciting new action in the sac. If the base is broad, dissect the soft parts from the sac, opening it by free incision on one side, removing a portion, but reserving a flap to be attached to the root of the pedicle on the other side of the opening into the spinal canal. Evacuation of the contents of the sac, pushing its collapsed parietes back into the canal, and uniting the soft parts over all sufficiently tight to prevent protrusion, may be attempted; these operations must be antiseptic.

Growths form about the sacrum and coccyx which are usually cystic in their character. They have been mistaken for spina bifida. When located about the coccyx they may grow to large size and become extremely inconvenient (Fig. 188). They should be cautiously removed with antiseptic precautions.

FIG. 188.



Congenital Coccygeal Tumor.

THE NOSE.

Imperforate nose may be congenital: it is then caused by a membrane stretched across the nostril or by firm fibrous tissue or by simple continuity of the integument. In congenital closure the interference with respiration and sucking often requires an early operation. In most cases a simple incision carefully made through the obstructing membrane, and the opening maintained by strips of lint or a short elastic canula, is sufficient. Sometimes it may be desirable to excise a portion of the obstructing tissue. When there is no indication of the opening of the nostril, the adherent parts must be gradually and cautiously divided until the nasal canal is restored.

Occlusion occurs at different points. Closure of the nostrils may be by membrane or by fibrous tissue, or result from catarrhal inflammation, or one ala or both may be adherent to the septum or even to the upper lip. As these defects interfere with respiration and prevent the infant from sucking freely, they demand early operation. Make a simple incision of sufficient extent carefully through the membrane, or excise a portion and keep it open by lint or canula until the cut surfaces are healed.

Narrowing or stenosis of the deeper passages may be sufficiently overcome in infants by the use of hollow bougies as dilators, or in more severe cases by forcible distension by means of a pair of thin, long-armed forceps, by the opening of which the abnormally approximated bones are separated. Bony closure of the posterior nares may exist from a continuation of the free posterior border of the palate-bones upward and backward. This occlusion may be overcome by perforation of the bony plate.

GROWTHS IN THE LARYNX.

The most frequent growths in the larynx in children are papillomatous in character. They appear as wart-like projections, and give rise to symptoms of laryngeal irritation, and, finally, of obstruction. It is difficult to bring them into view by inspection, owing to the struggles of the child.

Dr. H. S. Johnson of Chicago reported several cases of congenital papillomatous tumors of the larynx to the American Laryngological Association.[1] In one instance the tumor was expelled by coughing. The symptoms were cough, obstructed respiration in paroxysms, spasms, and finally complete arrest of breathing. The treatment of these growths in a child must be removal by thyrotomy or relief by tracheotomy.

THE URINARY BLADDER.

Extroversion of the bladder is a congenital malformation, occurring chiefly in males, in which the anterior portion and the parietes of the abdomen are absent, so that the posterior and lower part of the bladder protrudes, under the pressure of the viscera from behind, as a round red tumor covered by mucous membrane, in which the orifice of the ureters can be seen.

The linea alba bifurcates at the upper angle, but is continued on either side of the ossa pubis, forming a triangle; the pubic bones are not united by a symphysis; the penis is small; the ureter and corpus spongiosum are deficient in their whole extent; and the only remnant of the urethra is a groove lined by mucous membrane on the dorsum of the penis; the glans penis is full and large, and the prepuce is usually of full size, but cleft above. In the female there is no urethra nor clitoris, but the mucous surface of the bladder is continued directly down into the vagina.

This deformity leads to painful and distressing results, owing to the constant flow of urine over the groin and thighs, but it is in no respect dangerous to life. The treatment may be palliative, by the application of an apparatus to collect the urine, of which there are many kinds. But even the best fitting does not always obviate the gradual soaking by the urine of the skin of the abdomen, groins, and perineum, and hence operations have been devised to relieve the disgusting deformity. Efforts have been made (1) to open communication between the ureters and the rectum,[2] but the operation is very dangerous and has not given satisfactory results[3] (2), to cover the exposed surface; some of these operations have been very successful, and have become legitimate by the approval of good authority.

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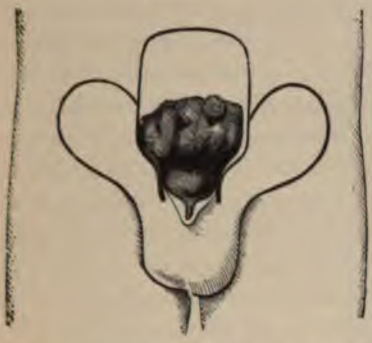
[1] *Med. News*, May, 1883.

[2] J. Simon.

[3] F. Jourdan.

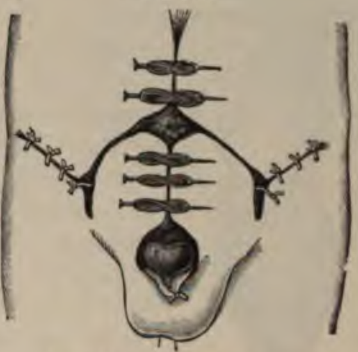
The most successful operations are as follows: Make an umbilical flap, 1 (Fig. 189),[1] and turn it down over the bladder; then make two

FIG. 189.



Wood's Operation for Extroverted Bladder: outline of incisions.

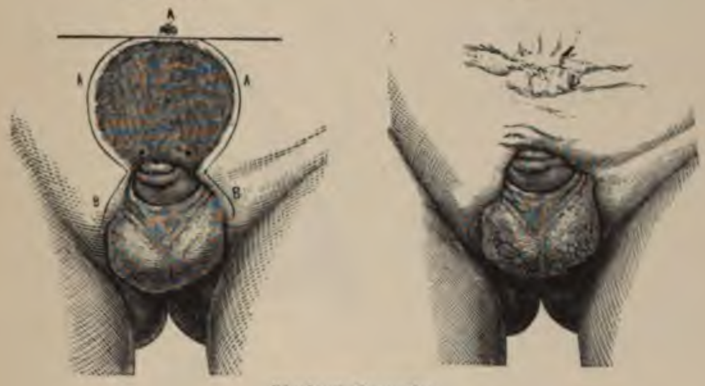
FIG. 190.



Wood's Operation: flaps applied.

flaps from the groin, one on either side (Fig. 189), and slide them over the central flap, and attach them in the median line (Fig. 190):[2] the

FIG. 191. Fig. 192.



Bigelow's Operation.

result is, the skin surface of the middle flap presents to the bladder, and the raw surface is covered by the raw surface of the lateral flaps; the new wound is left to cicatrize. Or dissect off the mucous membrane of the exposed bladder; make lateral flaps from both inguinal regions (Figs. 191, 192); unite them upon the median line and transversely above it; the points A, A, A and B, B being brought together, as the skin more readily yields in a direction obliquely upward; the result is perfect (Fig. 192).

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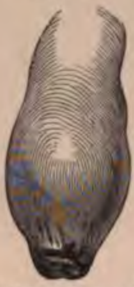
[1] Richards; D. Ayres; J. Wood.

[2] J. Wood.

PHIMOSIS.

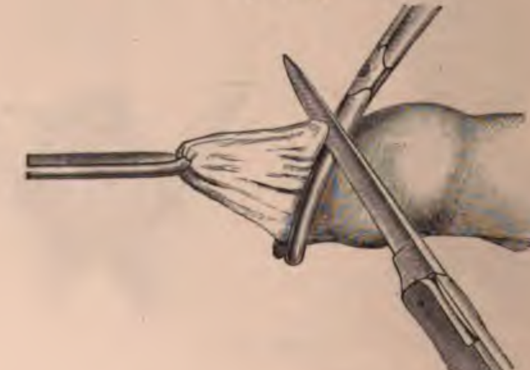
Phimosis is such a contraction of the prepuce that the glans cannot be uncovered. In the normal condition of the infant the prepuce is adherent to the glans, but later these adhesions are broken down and the prepuce becomes free. If, however, there is inflammation excited by irritants, as accumulations of filth under the prepuce, these adhesions may become firm, or the orifice may become inflamed and so dense that it will not yield, even to allow the free passage of urine. The affection may be a source of great discomfort in children, resulting in spasms of the muscles of different parts of the body, and in adults of collections of filth and foul matters. In performing this operation it is important to seize the orifice of the prepuce for the purpose of making suitable traction on the mucous membrane, which is but slightly elastic compared with the skin. First insert a well-oiled probe under the prepuce, and sweep the surface of the glans to break up adhesions; seize the prepuce with sharp-toothed forceps, and draw it forward until it is put well upon the stretch (Fig. 194); grasp the prepuce firmly just in front of the glans with forceps, and with the bistoury cut away the portion anterior to the clamp; the prepuce readily retracts; now with blunt scissors slit up the mucous membrane on the dorsum, trim its edges, and unite the mucous and skin flaps by a number of fine sutures; if the prepuce is not free, all tightness must be relieved in infants by tearing the tissues; the cut mucous membrane must be attached to the skin by numerous fine sutures beginning at the raphé; rest and water-dressings

FIG. 193.



Irritated Congenital Phimosis.

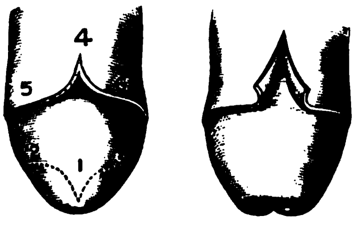
FIG. 194.



Circumcision.

only are required in the after-treatment. In slight cases it may be sufficient to slit up the prepuce on the dorsum and attach the edges as before. If there is a contracted prepuce after the excision, slit up the skin three to six lines on the dorsum of the penis (Fig. 195), trim the corners round, 5, 4, 6 (Fig. 196), incise the mucous membrane, 2, 1, 3 (Fig. 196), adjust the point 1 to 4, 2 to 5, and 3 to 6, with sutures, and the rest of the circumference by a sufficient number to hold them in position.

FIG. 195. FIG. 196.



Preparation of the Flaps.

HERNIA.

Direct inguinal hernia forms slowly, appearing first as a prominence behind the external ring, and having a more globular shape than the oblique; the finger enters the abdominal cavity more readily, and on the outer side of the orifice of the sac the internal epigastric artery is felt pulsating very distinctly; it traverses only that small portion of the inguinal canal which lies immediately behind the external ring, and pushes before it or lacerates the conjoined tendon in its passage and the pubic portion of the internal abdominal or transversalis fascia; it is enclosed between the epigastric artery, edge of the rectus, and Poupart's ligament.

Several forms of inguinal hernia are recognized, which depend chiefly upon the varying relations of the peritoneum. They have been explained as follows:[1]

(*a*) In congenital inguinal hernia the process of peritoneum which passes down with the cord, funicular process, remains freely open; the general cavity of the peritoneum is therefore identical with that of the tunica vaginalis testis forming the hernial sac, the bowel contained in which is in direct contact with the testicle (Fig. 197).

(*b*) The condition of the parts in an infantile hernia are as follows: The tunica vaginalis, 1 (Fig. 198), is closed above, at or near the external inguinal ring, but its funicular portion is open; the bowel in the hernial sac lies behind this funicular portion, and is represented in the diagram as having made its way between the funicular process and the cord; the relation of the sac to the cord seems, however, to be variable; the bowel is covered in cutting down from the skin by three layers of peritoneum—viz. 1 and 2, the opposite surfaces of the funicular process, and 3, the anterior layer of the peritoneal hernial sac.

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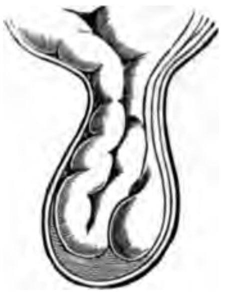
[1] T. Holmes.

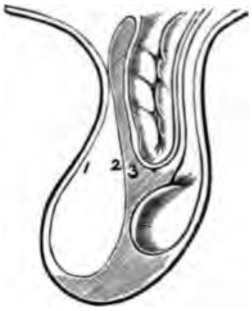
(c) In the encysted form (Fig. 199) of infantile hernia the bowel, instead of passing behind the closed funicular process, has distended the membrane which closes its upper end, and has pushed itself into the funicular process, the upper or back wall of which envelops it; in this case, therefore, the hernial sac is furnished by the funicular process itself, and only two layers of peritoneum cover the intestine.

FIG. 197.



Congenital Inguinal Hernia.

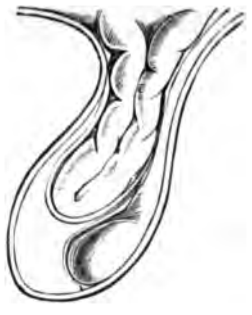
FIG. 198.



Infantile Hernia.

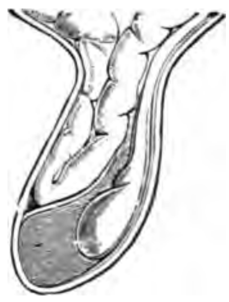
(d) In the common scrotal hernia (Fig. 200) the tunica vaginalis is seen behind and below, and is represented as distended with a certain amount of hydrocele fluid, but quite distinct from the hernial sac.

FIG. 199.



Encysted Form of Infantile Hernia.

FIG. 200.



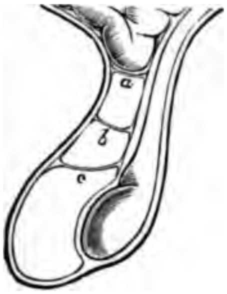
Common Scrotal Hernia.

(e) Partial obliteration of the funicular process illustrates the formation of cysts in the cord, encysted hydrocele of the cord (Fig. 201); the cavity of the tunica vaginalis testis is closed at *c;* the funicular process is also separated from the peritoneal cavity at *a*, the situation of the abdominal ring; there is also another septum at *b*. When one or more of these septa are absent or imperfect various conditions occur.

(*f*) In the formation of the hernia into the funicular process of the peritoneum (Fig. 202) the septum or obliteration at *c* is absent, so that the tunica vaginalis is open as high as the septum, *b*, which is imperfect or has given way from some accidental cause; in the diagram the septum at the external abdominal ring, *a*, is drawn as being widely open, but strangulation may occur either in the septum at *b*, somewhat lower down, or at both.

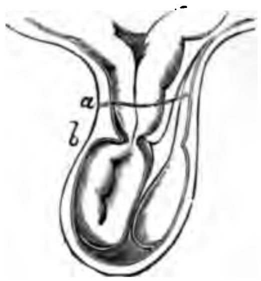
The symptoms and appearances of inguinal hernia are generally sufficiently characteristic, but even in the most marked case it is important, by a formal inquiry and the recognized tests, to distinguish it from different affections which occur in these organs and tissues.

Fig. 201.



Cysts of the Cord: encysted hydrocele.

Fig. 202.



Hernia into the Funicular Process.

The truss is the first appliance to be resorted to in reducible hernia: it should be applied immediately that the disposition to the formation of the rupture is detected, with a view to procure adhesions of the serous surfaces; the rule applies to both sexes and all ages, the only exception being a misplaced testis.[1] The effect of such pressure is to approximate the sides of the mouth of the sac, prevent the descent of the bowel, and lead to contraction and final obliteration of the hernial sac. As the commencement of a radical cure by truss-pressure dates from the last time the bowel or omentum came into the sac, it is of the first importance to prevent the hernia from ever coming down. About 15 to 20 per cent. may be cured by judicious and persistent truss-pressure.

In selecting a truss the following principles should be borne in mind:[2] The practice of rendering easier the adaptation of the truss and aiding the pad to keep its place by making it so conical as to press into the hernial opening like a cork into the neck of a bottle, should be carefully avoided: such a plug from without, acting upon yielding and distensible structures, is unscientific, and, instead of counteracting the dilating influence of the viscera within, is calculated to increase ultimately instead of diminishing the size of the rupture. The constant boring movement produced by the motion of the side-spring has invariably this effect when kept up long, as is demonstrated by the deep, pit-like depression left in the integument when the truss is removed.

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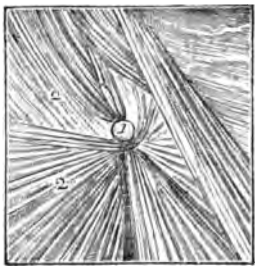
[1] J. Birkett.

[2] J. Wood.

The investing structures are pushed into the hernial apertures, and produce the same dilating effect from without as the protruding viscera do from within. The truss-pad should have its surface as nearly flat as its adaptation to the body will permit—should be shaped according to the form and outline of the rupture, should be as large as can be conveniently worn, should press upon the wall and sides of the hernial canal quite as much as upon its centre, should be so inclined as to face a little in the direction of the hernial canal, and in corpulent patients should be so inclined as to lie flat upon the sloping integuments. Violent and extraordinary efforts in coughing or straining cannot be effectually resisted by any amount of truss-pressure which can be continuously borne by the patient; hence the truss-spring should be helped under such circumstances by pressure with the hand upon the pad. No contrivance which has hitherto been employed to substitute the steel side or hip-spring is effective in giving real support to the rupture in cases of inguinal or crural hernia; straps and belts are yielding and incapable of such a degree of latent resistance, when passed in a circle round the body, as to be effective at the point required.

Umbilical hernia occurs at the point where the umbilical vessels pass through the abdominal wall; it exists anterior to the period when cicatrization is complete, which varies in different infants, but in general requires several months.[1] When the parts which fill the aperture are firmly cicatrized this point of the wall is firmer than the surrounding parts,[2] owing to the condensation of the cicatrix and the peculiar arrangement of the fibres of the transversalis fascia[3] (Fig. 203).

FIG. 203.



Fascia at Umbilicus.

In infants the protruding viscus pushes before it that portion of the parietal peritoneum lying immediately behind the aperture in the linea alba, through which the umbilical vessels enter the abdominal cavity; the hernial sac thus formed before the closure of the ring is effected may pass into the connective tissue of the cord itself before that structure has separated; after the separation of the cord the hernial sac may be protruded in consequence of the umbilical aperture remaining imperfectly closed when it is covered only by the integuments; in the youth the hernia may escape through a partially closed ring, which it dilates by continual pressure; in the adult the fibres of the linea alba may become separated by stretching, owing to the pressure within, and the hernia escape at the site of the once closed ring or in its vicinity (Fig. 203).

The hernia begins by forming a soft, projecting, ovoid tumor at the navel; at first it may be reduced by pressure, when a small hole is felt with very sharp and rigid edges; if the finger is removed, the skin either remains relaxed in the fossa of the navel or it is slowly projected forward; as the disease progresses the protruding viscus descends lower and lower, so that the broadest part lies below the mouth of the sac; the tumor varies much in form, the transverse diameter being sometimes greater than the vertical; occasionally it is pyriform, and seems suspended or spread out like a mushroom (Fig. 204); again, its base is nearly as large as its body; in infants the hernia usually contains intestines, but in the adult omentum is generally added, and sometimes the stomach; the coverings, usually very thin and often inseparably united, are the integument, some fat, the internal abdominal fascia, the sac; the body of the sac is usually very delicate, but stronger near and at its orifice, around which the tissues form a firm, resisting, unyielding band; the mouth of the sac is often large in proportion to the bulk of the protrusion.

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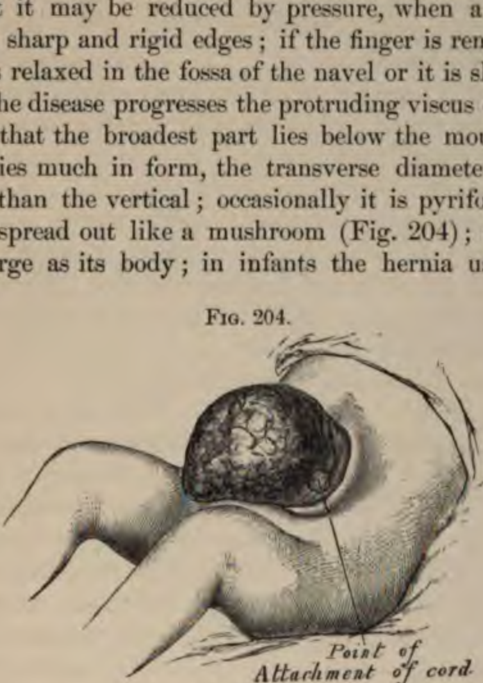
[1] W. Lawrence.
[2] A. Scarpa.
[3] Frorieps.

FIG. 204.

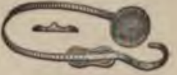


Congenital Umbilical Hernia.[1]

Umbilical hernia, if congenital, should at first be treated with a piece of lint wrapped around a penny-piece and kept on with a light flannel bandage, lightly swathing the infant's body and kept from chafing by powdered starch.

This form of hernia seen in the infant requires persistent efforts to close the opening by the following dressing: Apply a flat pad of any soft and tolerably firm material, moulded to the shape of the parietes and extending beyond the margin of the opening (Fig. 205); maintain it in position by adhesive strips or by a broad elastic band properly padded; remove the apparatus frequently to preserve cleanliness and prevent chafing, the finger being applied meantime to the opening. Radical cures have been effected by the truss.

FIG. 205.



Umbilical Truss.

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[1] T. Bryant.

DISLOCATIONS.

Dislocations are rare in infancy. The symptoms and treatment are not peculiar to this class of patients. The cause is almost invariably some injury during birth. There may be no other injury than rupture of the capsule, simple dislocation, or there may be a wound of the integument entering the joint, compound dislocation. The signs of dislocation are preternatural immobility, and tendency, when reduced, to remain, but with free motion without crepitus. The treatment required is immediate reduction; anæsthetics must be used for relaxation; when reduction is possible by manipulation this method should always be preferred; if more force is necessary, make extension and counter-extension with the hands, aided with bandages tied in the form of the clove-hitch; if more power is required, resort to mechanical contrivances, as the pulley. Compound dislocations are among the most serious accidents which can befall a limb, but it must be borne in mind that by the proper use of antiseptic dressings these injuries may now be treated without suppuration, and are therefore far more amenable to conservative measures than formerly. The treatment must depend upon the amount of injury in each case; if slight, reduction may be effected by suitable enlargement of the wound, followed by thorough cleansing and disinfection; resection should be made when the bones are destroyed, the antiseptic dressings being employed; amputation will be necessary when the principal artery of the limb is ruptured or there is great destruction of the tissues about the joint.

FRACTURES.

Fractures discovered at birth may have occurred *in utero* or during parturition. Intra-uterine fractures are caused by external violence to the abdomen, or more frequently are the result of intra-uterine rachitis: they may be simple or compound. The simple intra-uterine fracture may unite before birth. Bryant[1] of London states that he saw a child born with a humerus bent at right angles, evidently from a repaired intra-uterine fracture. The compound fracture occurring *in utero* has resulted in wounds of the internal surfaces of the uterus, causing hemorrhage followed by abortion.

Fractures occurring during delivery are generally caused by too violent traction, or by forcible efforts to change the position of the child in version, or by the pressure of forceps. The kind of injury inflicted may be a separation of the epiphyses, or a simple fracture, or a compound fracture.

The bones of a healthy infant are much more elastic than at a later period of life, owing to the presence of unossified cartilage, and hence they bend under violence rather than break. When the force is so great that the bone yields, the fracture is likely to be partial, like a green stick, and transverse rather than oblique (Fig. 206). Green-stick fracture, however, is more frequent in some bones than others, notably in the clavicle and in the bones of the forearm. In children we meet with separation at the epiphyseal junction. This is an accident rarely met with in the adult. In all lesions of the long bones in the vicinity of joints in children it is important to remember that the injury to the bone may be separation at the epiphyseal junction. The practical significance of this lesion is the liability to impairment of the future growth of the limb.

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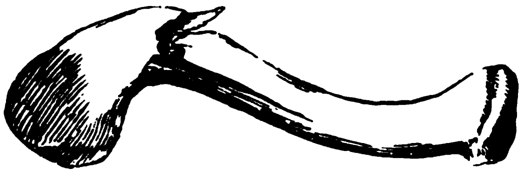
[1] *Prac. of Surg.*

FIG. 206.



"Green-stick" Fracture of the Clavicle.

The diagnosis of fracture is often difficult, owing to the rapid swelling of the parts, which may create or efface deformity. It is usually safe, when a great amount of swelling exists, to place the limb in a comfortable position until the swelling subsides. But the delay in determining the nature of the injury should not exceed six days, as the union of fragments in healthy children is very rapid. If necessary to a positive diagnosis, an anæsthetic should be given.

If the bone is simply bent, and not completely separated, an effort should at once be made to forcibly straighten it under an anæsthetic, for repair in these cases is very prompt.

If, however, the fracture is complete, the ordinary dressings employed for similar fractures in adults should be applied.

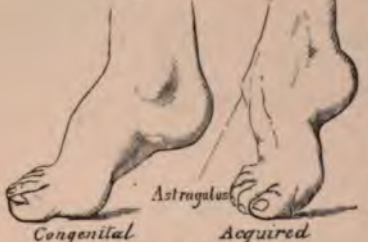
CLUB-FOOT.

Talipes equinus (Fig. 207) is usually congenital. The treatment is operative and mechanical. The tendo Achillis and plantaris may alone require division, or, in addition, the plantar fascia must be cut, as when the arch of the foot is strongly contracted : the foot should usually be brought into position at once and retained by splints or the gypsum bandage.

Distortions of the feet may be due to spasmodic action of one class of muscles, the antagonizing muscles acting normally, or to paralysis of one class, the opposing muscles being healthy. Careful examination of each case will determine whether spasm or paralysis is the cause; but, in general, congenital cases are caused by spasm, and non-congenital by paralysis. The general rule of treatment is to endeavor to overcome by appliances those deformities which readily yield to manipulation and are caused by paralysis, and to divide contracted tendons in those which do not yield readily and are caused by spasm. The objects of treatment are the restoration of form and function, and the means to be employed are physiological, mechanical, and operative.

Fig. 207.

Talipes Equinus.



Club-Foot.

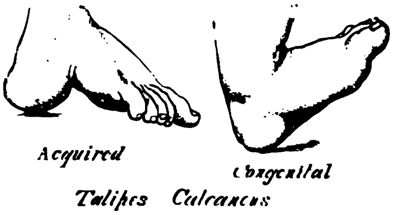
The scientific treatment of severe deformities can only be accomplished by a judicious combination of these three methods, and many of the failures are due to the want of this combination of principles too frequently considered antagonistic to each other.

Selecting talipes varus, the most frequent example of club-foot, the rules of treatment as regards the adoption of the several methods are as follows: (1) If no obstacle exists to the perfect restoration of form by gentle application of force, the defect may be remedied by the manipulations of the nurse, aided in more marked cases, if necessary, by simple mechanical appliances, as rubber, plaster, a boot with springs. (2) If the foot can be nearly but not quite restored to its natural form by the hand, the heel remaining somewhat elevated so as to limit or prevent flexion at the ankle-joint, tenotomy is justifiable, as it greatly hastens the cure. (3) In the more severe grades tenotomy is indispensably necessary: these cases are recognized by the following features: namely, the foot cannot be fully everted or brought to a straight line with the leg by manipulation, and in the attempt to effect this the inner malleolus does not become prominent; (4) the os calcis either cannot be depressed at all, or only to a slight degree, so that after the partial eversion of the foot little or no flexion at the ankle-joint can be obtained.

The following summary of principles of treatment of congenital club-foot deserves attention: 1. Whether the case promises favorably for mechanical treatment only, or needs, as the majority of cases do need, operative interference, commence the treatment as soon after birth as practicable. 2. Reduce the distortion from the state of a compound one (varus) to the simpler form (equinus) by first curing the inversion of the foot and the tendency to involution of the sole. 3. Avoid the slightest undue pressure upon prominent points of the leg and foot by careful padding of the hollow parts and by using only gentle pressure with any bandage; avoid obstruction of the returning blood from the limb. 4. Remove splint and bandage daily, practice gentle movements of the foot in the desired direction, endeavor to prevent the part remaining for an instant unsupported and liable to fall back into the deformed position, until it is found that the foot, on removal of the bandage, retains a perfectly good position and flexibility. 5. Never permit the child to be placed on the feet or to walk until the form and movements are complete, whatever may be the age of the patient. The only apparatus necessary to carry out this treatment is a splint of tin or pasteboard so adapted to the external parts as to leave a space between the foot and splint when bandages are applied, or rubber plaster applied to the anterior part of the foot and passing up the external surface of the leg to which it is fastened.

Talipes calcaneus[1] (Fig. 208) is both a congenital and non-congenital affection. In congenital cases the deformity is of the simplest kind, the position of the foot being an exaggerated degree of flexion. In ordinary cases the treatment required is passive exercise and the use of a soft-padded splint applied in front of the leg and foot. In severe cases, with much contraction of the anterior muscles, the tendons of the tibialis anticus, extensor proprius pollicis, extensor longus digitorum, and peroneus tertius should be divided.

FIG. 208.



Non-congenital calcaneus is usually the result of infantile paralysis, and as a consequence tenotomy is seldom required; palliative treatment alone must be attempted by the application of a proper shoe.

Talipes varus[1] in its severe form has the following external characters (Fig. 209): namely, the anterior portion of the foot is turned inward, forming a right angle; the sole looks directly backward and the dorsum forward; the inner border looks directly upward, and the outer directly downward. The first stage of treatment consists in correcting the varus by turning the foot outward into a straight position or by bringing the sole squarely downward; the second stage consists in overcoming the elevation of the heel (equinus) if that exist. If the foot can be brought around nearly straight with comparative ease, the effort should be made by manipulation and bandaging to correct the deformity. This may be effected by many methods: (1) Apply a strip of adhesive plaster around the anterior part of the foot, commencing on the dorsum and passing around the inside, then across the sole to the outside, and then, while the foot is turned strongly outward, up the outside of the leg to the knee; over this dressing apply a roller bandage; repeat the dressing every second day (Fig. 210). Apply a splint adapted to the outside of the limb, with a foot-piece at an angle with the foot and, beginning at the upper part, bandage the leg and foot to the splint (Fig. 211); change the dressing every second day, giving to the foot strong traction externally.[1] (3) Give the patient chloroform, and, after forcing the foot outward fifteen minutes, apply a gypsum bandage; repeat the dressing weekly.[2] In cases which require tenotomy divide the tibialis anticus and posticus, and, if necessary, also the tendo Achillis and flexor longus digitorum; after the healing of the wounds apply the club-foot shoe.

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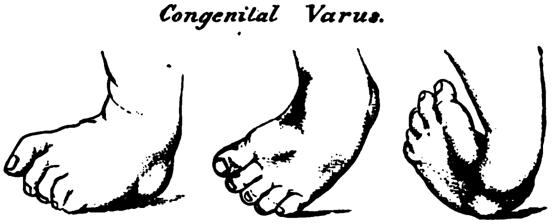
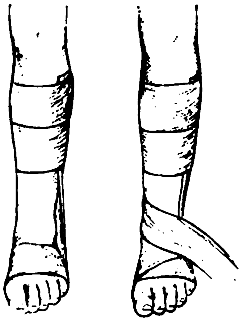
[1] W. Adams.

FIG. 209.



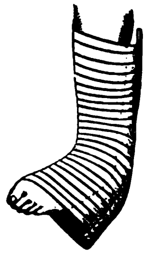
Club-Foot: three grades of severity.

FIG. 210.



Mode of Stretching Foot in Talipes Varus by Strapping.

FIG. 211.



Varus Treated by Bandage.

The removal of a triangular mass from the tarsus[3] on the outside has been successfully practised in severe cases[4]; the steps of the operation and the results will be understood by the illustrations (Figs. 212, 213, 214).

Talipes valgus (Fig. 215) is rarely congenital. Marked cases, without rigid muscular contraction, may be cured mechanically in a few months without tenotomy, but severe cases demand a combination of operative, mechanical, and physiological means. The tendons requiring division in the slighter cases are the peronei and extensor longus, and the tendo Achillis, if involved; in very severe cases the tibialis anticus and the extensor pollicis must also be divided. The mechanical treatment of slight cases in which the tendo Achillis is not divided is as follows: A convex pad of vulcanized india-rubber is placed inside of the boot in the normal situation of the arch of the foot which it is intended to support; it should extend halfway across the sole of the foot, and rise on the inner side so as to support the navicular bone; the heel should be raised on the inner side about a quarter of an inch, so as to twist the foot inward and throw the weight on the outer side. In more severe cases it is necessary to add a steel support attached to the outer side of the boot and carried up to the calf of the leg, where it is

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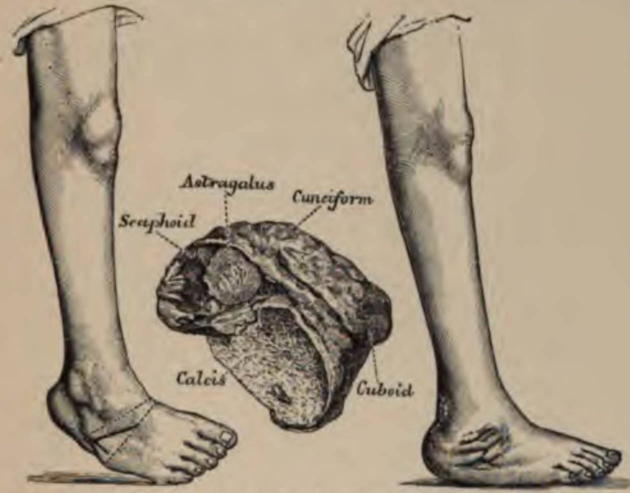
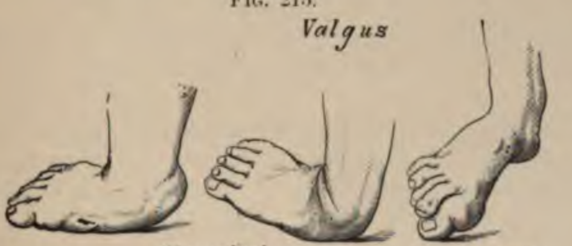
[1] W. J. Little. [2] A. Ogston. [3] D. Colley. [4] T. Bryant.

FIG. 212. FIG. 213. FIG. 214.



Foot before Operation. Bones Removed. Foot after operation.

FIG. 215.



Club-foot.

connected with a semicircular steel plate and a strap which encircles the leg; a free joint should correspond with the ankle, and a leather strap attached to the inner side of the boot should pass across the ankle-joint and buckle outside the steel support. In the most severe cases, after tenotomy is performed, a shoe must be applied which effectually brings the foot by degrees into position.

CONGENITAL ANOMALIES OF THE EYE.

By G. E. DE SCHWEINITZ, M. D.,

PHILADELPHIA.

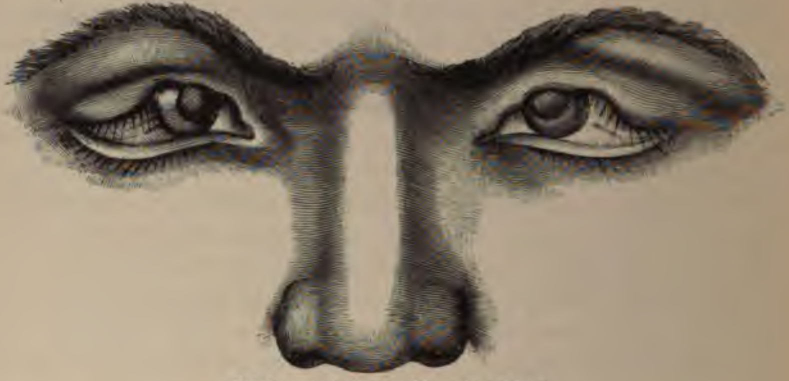
It is the purpose of the present essay to give a brief description of some of the congenital malformations of the eye and its appendages, and of certain of the defects of this organ which result from intra-uterine disease. It would be manifestly impossible in a work of this description to even enumerate the entire list of congenital anomalies of the visual apparatus, nor would practical advantage be gained by an attempt to give an account of such irregularities in development as belong more exclusively to the domain of ophthalmology, and for whose study special training and special instruments of precision are necessary. For the consideration of these the student will naturally turn to the systematic writers upon ophthalmology and to the many elaborate monographs which are extant. For these reasons all descriptions of the congenital defects of the deeper structures of the eye—the choroid, retina, optic nerve; in short, all such anomalies as need for their detection ophthalmoscopic examination—have been omitted, and for obvious and similar reasons the treatment of these defects, where treatment is possible, except in incidental allusion, has not been included. There are, however, some congenital malformations of the eye, readily noted directly or soon after birth, which must be of interest alike to the obstetrician and to the ophthalmologist—malformations which may be studied without the aid of instruments, or at least with the help of ordinary oblique illumination.

Failure of development in the eye, as Manz has pointed out, is among the most frequent of teratological phenomena, and it is not improbable that the relative great frequency of these defects depends upon the fact that in the eye even slight departures from the normal structure are easily observed.

CONGENITAL ANOMALIES OF THE EYELIDS.

COLOBOMA OF THE LIDS appears in the form of a fissure which may be confined to the upper lids, either one or both, but which has also been noted in the lower lids, and even in both upper and lower lids. Dor of Lyons[1] has, with the aid of Jules Nicolin,[2] collected 47 cases of coloboma of the eyelids and 12 observations of oblique fissures of the face accompanied by palpebral coloboma. In 27 instances a single eyelid was involved, twice the two lids of the same eye, 16 times one lid of each eye, and once the deformity appeared on all four lids. In the majority of instances the defect is found in the upper lids. In an analysis made by Van Duyse,[3] and further elaborated by additional cases by D'Oench,[4] this position was noted 23 times in 33 cases, while 9 times the lower lid was affected.

FIG. 216.



Coloboma of the Eyelids (after Manz).

The cleft involves the entire thickness of the lid, with an intercalary portion between, which, for the most part, is composed of skin tightly pressed against the cornea or freely movable, or which is represented by a dermoid of the cornea. The situation of the coloboma when in the upper lid is in the middle; when in the lower lid the inclination is to the nasal side.

Coloboma of the eyelids may exist as a single malformation, but has more frequently been seen in conjunction with hare-lip (14 times in 47 cases), absence of the lachrymal puncta, dermoid tumors of the cornea, or, as in a case recorded by Schiess-Gemuseus,[5] where it was associated with coloboma of the iris and clefts in the pharynx, lip, and nose.

A variety of theories have been advanced to explain this anomaly. The older writers ascribed it to a primordial defect of organization; later, it was attributed to an arrest of development; still more recently, the hypothesis of Van Duyse, that its formation was due to the action of the amniotic strands, has received acceptance. Mention should be made also of Manz's theory of heterotopic tissue-formation, and that of Osio, who explained the occurrence upon the grounds of an intra-uterine inflammation. Nicolin and Dor,[1] with the belief that these explanations are insufficient, have studied coloboma of the eyelids in connection with the pathological anatomy of facial fissures, especially of the oblique fissures of the face, and have attributed to it a similar origin with them; that is, the result of an arrest of development at a time when the eyelids have as yet no existence, but when a failure of the joining of the two halves of the first branchial arch, together with the frontal prominence, determines an arrest of development which opposes itself later to the normal formation of the eyelids and gives rise to coloboma.

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[1] *Revue générale d'Ophtalmologie*, December, 1888.

[2] *Du Colobome congenital des Paupières*, Lyons, 1888.

[3] *Ann. d'Occul.*, 1882.

[4] *Archiv. of Ophthalmology*, vol. xv.

[5] *Zeh. Klin. Monatsbl. f. Augenhk.*, vol. xxiv. p. 8.

The deficiency may be remedied by freshening the edges of the gap and bringing together the opposed surfaces.

SYMBLEPHARON.—Symblepharon, as the name indicates, is a condition where there exists a cohesion between the eyelids and the ball. It may be complete or incomplete, although it is doubtful if any case, as Manz contends, of complete congenital symblepharon has been satisfactorily described, unless certain instances of cryptophthalmos, where a complete adherence between the skin of the lids and the eyeball has taken place, should be so accredited. In the case of incomplete symblepharon the teratological character may not always be safely assumed, as certain instances result from a fœtal inflammation. The eyelids are formed at the end of the third month as small cutaneous folds which come together in front of the globe, and are pressed tightly against the cornea of the growing eyeball: before the end of fœtal life this union is broken up, but if for any reason there is a failure in development of the ball or in the functioning of the eye-muscles, the separation does not take place and congenital symblepharon results.

ANKYLOBLEPHARON, or a union between the margins of the lids, appears in various forms in newborn children, and, like symblepharon, is seen in connection with other anomalies of development, appearing in its most total form in connection with anophthalmos—a condition presently to be described—or as partial cohesion, which, when merely the outer angles of the lids are involved, has received the name *blepharophimosis*. Sometimes instead of the adherence between the outer commissure, it is merely the middle portions of the lid-borders which are attached to one another, as, for example, in a case recorded by v. Hasner,[2] where the defect was found in the left eye of an otherwise healthy newborn girl, and was in the form of a thread, which, although not very thick, was still strong enough and so short that it hindered the entire opening of the fissure of the lids. As with symblepharon, many authorities are inclined to attribute such appearances to the results of a fœtal inflammation of the lid-borders, while others regard them as failures of development. In the beginning the lids are simply folds of ectoderm which pass gradually downward (the upper) and upward (the under). Their coalescence is afterward divided in the line of the later palpebral fissure. If this separation fails to take place, ankyloblepharon results. The treatment of such conditions should be conducted upon the same principles which govern the management of these deformities when they arise from the various pathological reasons which are their sources of origin in later life.

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[1] *Loc. cit.*

[2] *Prag. Zeitschr. f. Heilkunde*, 1883.

Absence of the Lids.—Under the general terms of *ablepharia totalis* and *partialis* defective development of the eyelids of different grades has been gathered together. The defect may be of such a nature that the lids themselves are wanting and the entire orbit is divested of any covering for the bulb: this produces the highest grade of *lagophthalmos*. In another variety the eyeball is entirely invisible, because the outer skin is drawn over it without the presence of the palpebral fissure—a condition to which Manz has given the name *cryptophthalmos*, and which is seen both in association with anopthalmos, or absence of the eyeball, and when the eyeball exists.

As Van Duyse[1] has correctly observed, the name cryptophthalmos should be preserved for those cases where the exterior integument passes in front of an eye more or less developed—*i. e.* where there is complete absence of the lids and palpebral fissure. If there is an absence of the eyeball, together with absence of the lids, the designation should be "ablepharia totalis and anophthalmos," not "cryptophthalmos with anophthalmos," which is, of course, a contradiction in terms. This condition, thus defined, is of extreme rarity. In such a case described by Van Duyse[2] a child of three weeks was found to be so deformed that the skin of the forehead passed in front of the eyes and joined with that upon the cheeks. Beneath this the eyeballs could be seen to move. In addition, there were other vices of conformation, most important among which were the imperfect development of the parietal bone and a meningo-encephalocele.

Fig. 217 is taken from the phototype which accompanies Van Duyse's paper. Such phenomena may be explained upon the theory of an arrest of development associated with failure in the evolution of the anterior structures of the eyeball. As in other deformities of the face, like the persistence of certain fissures, and in the eyelids, as in coloboma, the theory of amniotic attachments as factors in its formation has been thought of in connection with the condition just described.

In addition to a partial or complete absence of the eyelids, cases are on record in which they have been abnormally short. Thus Fuchs reports two such instances of abnormal shortness of the lids, so that the patients could close them only by the strongest pressure. Pflüger observed in a patient an abnormal length of the fissure of the lids, where complete closure was only possible by the greatest effort. Ectropium was not present.

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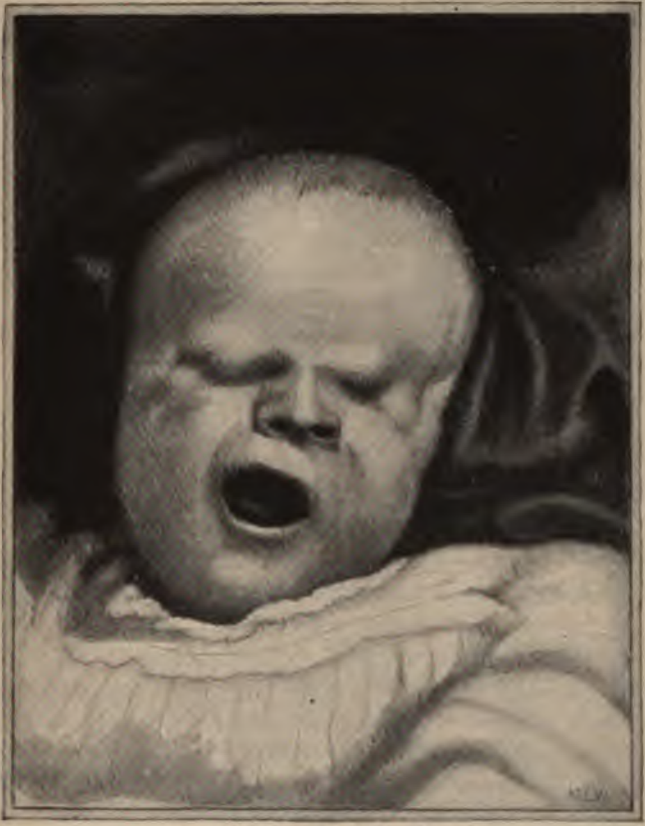
[1] *Annales d'Oculistique*, Jan.-Feb., 1889.

[2] *Loc. cit.*

Fig. 217.



Cryptophthalmos (after Van Duyse).

Distichiasis, or the development of supplementary incurved rows of cilia, is often congenital, and is sometimes spoken of under the title of *distichiasis congenita*. In this condition the lashes of the outer edge of the lid are normally placed, but from the intermarginal part, close to the opening of the tarsal glands, a second row of cilia appears, which rubs against the eyeball. It may be seen as an unassociated congenital anomaly or in connection with other defects; for instance, in one case observed by Schweigger there was epicanthus and ptosis, and in another a cleft palate. The second row, or the increased number of the hair-follicles, is produced when the ordinary follicles are generated, but it is probable that in many instances this remains quiet, and the supernumerary row of lashes does not appear until about the age of puberty, when it springs forth under the same impulse which the growth of hair in other regions receives at this age. Complete absence of the eyelashes has been recorded as an unusual anomaly.

CONGENITAL PTOSIS.—Congenital ptosis, as usually seen, consists in a drooping of the upper lid over the eyeball, so that its lower margin covers the upper border of the pupil or its middle, or even sinks lower still. Under any circumstances it cannot be elevated above the points just mentioned. It may be either unilateral or bilateral, usually the former. It has been observed within the first few days of life by Horner, and is occasionally present in succeeding generations of the same family, this author having seen it in three successive generations. It is not an uncommon defect, and, like other malformations, is frequently seen in association with vices of conformation in other organs of the body, and especially with defective movements of the external eye-muscles and with the condition known as epicanthus. Horner records a case in which there was limitation in the movement of the superior rectus, and I have myself seen an instance where the ptosis had been present since the earliest days of babyhood, and was associated with a divergent squint from paresis of the internal rectus. Ptosis has usually been divided by systematic writers into two varieties: those in which there was a positive hypertrophy of the connective tissue, so that the upper lid overhung the lower because of this redundancy of the lid-tissue; second, those in which the drooping was due to absence or imperfect development of the levator palpebrarum, or to a paralysis of this muscle. Its presence, also, has been attributed to the pressure of the forceps during birth, but Horner[1] very properly is not willing to concede this theory, inasmuch as he has seen this affection in the first days of life, and, moreover, without any mark of the instrument upon the face of the child, and has followed it through several generations of one family. Furthermore, the frequent association of this defect with epicanthus, ankyloblepharon, and other abnormalities militates against this idea.

EPICANTHUS.—Epicanthus is the name which v. Ammon gave to a somewhat rare affection in which, owing to an excessive development upon the bridge of the nose, a fold of skin passes from the inner end of the brow to the side of the nose and covers the internal canthus. The concave free border, which stretches outward, hides the commissure of the lids, the caruncle, the lachrymal puncta, and, in aggravated instances, a considerable portion of the area of the lids. Epicanthus is generally bilateral, and is usually associated with congenital ptosis.

As Horner[2] has pointed out, an examination of this region in newborn children, and a comparison of it with the bridge of the nose and the folds of the lid, might readily lead to the belief that a low grade of epicanthus is very common. This appearance, however, disappears in the later development of the face and nose. The fact that the free border of the abnormal fold of skin may nearly cover the sclera, between the margins of the cornea and the inner commissure, gives rise to an appearance as if a convergent strabismus was present; and v. Graefe expressed the opinion that epicanthus depended essentially not so much upon the development of an abnormal fold of skin as upon an insufficiency of some of the twigs of the oculomotor nerve, especially those which pass to the levator palpebrarum and the superior rectus. Moreover, Hirschberg[1] has demonstrated a connection between epicanthus and ophthalmoplegia, in which the defect appeared to be due to a congenital aplasia of the gray nuclei below the aqueduct of Sylvius: the fold of the skin extending from the upper to the lower lid, which is generally regarded as characteristic of epicanthus, was absent. It is not improbable, however, according to Manz,[2] that all of these and similar anomalies have a common origin in the development of the bones of the face which are concerned in this region. This abnormality may appear in several members of the same family; thus, Alvarado observed three cases of epicanthus in the father, son, and daughter, in which the superfluous tissue appeared like a tumor. Some authors[3] have described under the name of *epicanthus externus* a somewhat analogous affection in which the fold of skin was observed to

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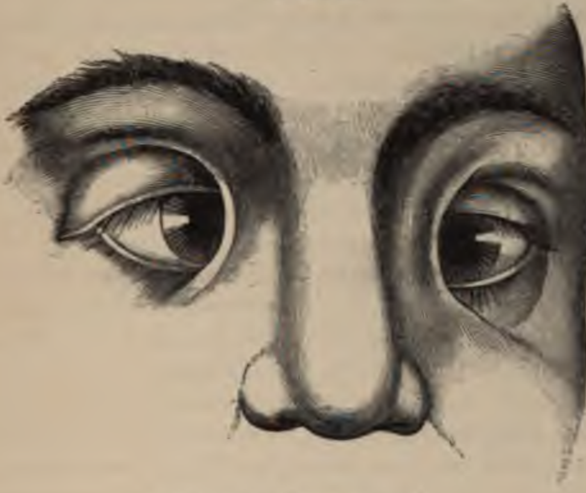
[1] Gerhardt's *Handb. d. Kinderkrankheiten.*

[2] *Loc. cit.*

FIG. 218.



Epicanthus (after v. Ammon).

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[1] *Neurolog. Centralbl.*, 1885, No. 13.

[2] Graefe und Saemisch: *Handbuch der gesammten Augenheilkunde.*

[3] Quoted by Manz, *loc. cit.*

cross the outer angle of the eye. If a child born with epicanthus does not lose this appearance in the course of the development of the bones of the nose and the face, an attempt may be made to remedy the deformity by excising a portion of the redundant integument from the bridge of the nose and stitching together the opposed surfaces.

ANOMALIES OF THE LACHRYMAL APPARATUS.

The anomalies of the lachrymal apparatus which appear most frequently are those of the canaliculi and the puncta. These may be double, as in the cases recorded by Mooren, Galezowski, Horner, and other observers, while a much rarer congenital anomaly is the absence of the tear-passages and even of the tear-sac. V. Reuss has described the case of a boy in whom all four of the lachrymal points were absent, while the papillæ were present, and the canals were represented in the lower lids by furrows; in the upper lids they were wanting. Bader also describes complete patulency of the canaliculus.

CONGENITAL FISTULAS of the lachrymal sac have not been infrequently observed, appearing in the form of a fine opening on its anterior wall, from which a drop of fluid may be seen to ooze. These may be single, or, as Agnew[1] and others have recorded, double. Doubt has sometimes been cast upon the question whether a fistula of the tear-sac can occur as a congenital anomaly. It is, however, perfectly reasonable to assume that this defect may result from an imperfect closure of the eye-nasal groove. It is well to remember in this connection, as a matter entirely apart from congenital disease, that suppuration of the lachrymal sac, on one or both sides, sometimes takes place in newborn infants without assignable cause, and this may open on the face, leaving a fistulous orifice. Kipp found during a two years' service 3.6 per cent. of cases of lachrymal disease, and 10 per cent. of these were under one year; the disease was often seen shortly after birth.

Tumors are not infrequently found congenitally in connection with the lachrymal gland. The form in which these new growths usually appear is that of an hypertrophy of the gland, or an adenoma, or more rarely, as a species of cystic degeneration.

ANOMALIES OF THE CONJUNCTIVA.

Among the congenital anomalous conditions of the conjunctiva mention need only be made of DERMOID TUMORS, a more detailed description of which will presently be given when discussing the defects of the cornea. Besides these dermoid growths other congenital changes and thickenings of this membrane have been described, as, for instance, a malformation resembling external pterygium, a case of which has been recorded by Strawbridge,[1] where a growth of thickened conjunctiva sprang from the outer commissure and covered the corneæ to fully one half their surface. The case came under observation when the child was six weeks old.

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[1] "A Case of Double Congenital Lachrymal Fistula," *Transactions American Ophth. Soc.*, 1874.

Of most interest to obstetricians are the affections of this membrane grouped under the name ophthalmia neonatorum, the origins of which are to be sought for, except in a few rare instances, during or immediately after parturition, and which are fully dealt with in another section of this volume.

Anomalies of the Cornea.

Microphthalmos, or that condition where the entire eye remains in a more or less rudimentary condition, and where the cornea is too small in all its diameters, is observed both as a unilateral and a bilateral affection. The imperfect development of the eye may appear in the form of an atrophy of the various constituents of the globe, which still remain in due propertion, as in an example of symmetrical microphthalmos described by F. R. Cross,[2] or as in a case detailed by Carl Hess,[3] where all parts were histologically perfect, except a cataractous lens, but of diminutive size. Such cases of pure microphthalmos are, according to Manz, among the greatest of rarities, and for which we have no adequate explanation: usually one or other of the component portions of the globe may be wanting, as, for instance, the lens, or coloboma of the iris, choroid, or retina, or cystic change in the interior of the bulb may be found. Examination of the orbit in a case of microphthalmos may reveal either the presence of a bulbus externally of normal shape, but of diminutive size, or the space within may be wellnigh empty except for a small white elevation which moves in co-ordination with the other eye. So devoid of contents may the orbit appear that the case may be looked upon as one of anophthalmos, or absence of the eye. Indeed, Michel mentions an instance of such a nature where only cartilage existed behind the apex of the conjunctival sac, which, however, as Manz has suggested, might be looked upon as the rudiment of an eyeball.

Many views have been expressed in regard to the etiology of microphthalmos. Kundrat believed it was due to a retarded growth of the cerebellum; Arlt attributed it to delayed or incomplete closure of the fœtal ocular cleft; Wedl and Boch incline to the doctrine that a fœtal illness *in orbita* and its structures may cause a retardation of the growth of the globe. Deutschmann's theory that microphthalmos was caused by intra-uterine inflammation, and was, in fact, a sclero-chorio-retinitis, has received a wide acceptation among many observers. In order to fully appreciate the genesis of microphthalmos, examination must first be made how far the normal development has progressed in the bulbus under consideration, and according to the findings a determination at what part of the evolution of the eyeball the arrest of development first began may be reached.[1]

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[1] *Transactions of the American Ophth. Soc.*

[2] *British Medical Journal*, ii. p. 1153, 1885.

[3] V. Graefe's *Archiv für Ophthalmologie*, 1888, vol. xxxiv.

Here, as with the other congenital defects of the eye, the question of heredity deserves mention. Hereditary disease may be present at birth, and, as Fuchs[2] declares, it usually appears in a similar or analogous form in the parent and the offspring. In support of this may be mentioned the instance in which a man blinded by ophthalmia neonatorum begot two children, both of whom possessed microphthalmic eyes. In the second instance the right eye of the father was destroyed in early childhood by an irido-cyclitis, and the corresponding eye of his son was microphthalmic. These facts deserve more consideration than that which might be accorded to a mere coincidence, inasmuch as Deutschmann has obtained similar results in experiments on the lower animals.

CONGENITAL HYDROPHTHALMOS, or BUPHTHALMOS, or CORNEA GLOBOSA, as the affection is variously designated, is a disease of early childhood, the incipient stages of which are believed to be intra-uterine. The characteristic appearances consist in a great enlargement of the cornea in all its diameters, increased depth of the anterior chamber, a tremulous state of the iris, and a marked thinning of the sclerotic coat. In the later stages of the affection the cornea not infrequently becomes hazy, the *keratoglobus turbidus* of some writers. The precise cause of this condition has not been accurately determined. It has been ascribed to an intra-uterine irido-keratitis with increased intraocular pressure; in other words, a form of congenital glaucoma. M. Durr,[3] in an anatomical examination of several megalophthalmic eyes, found that the larger oblique muscles presented a greater obliquity than is ordinarily the case, and were rolled round the globe so tightly than an impression was left on the surface of the sclerotic, the result of which was a noticeable compression of the emergent veins. The prognosis, as far as sight is concerned, is distinctly unfavorable; the affection, in spite of operative interference and the use of eserine, often progresses to blindness.

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[1] Those interested to pursue this subject further should consult the elaborate papers of Dr. Carl Hess of Mainz and Dr. Herman Becker in v. Graefe's *Archiv f. Ophthalmologie*, vol. xxxiv., 1888.

[2] *Causes and Prevention of Blindness*, 1885; *Ophthalmic Review*, iv., 1885.

[3] *Ann. d'Oculistique*, July and August, 1888.

SCLEROPHTHALMIA is the name which is sometimes applied to that condition when the opacity of the sclerotic, instead of stopping at the margin of the cornea, encroaches upon this membrane in such a manner that it may be only the central portion remains transparent. In other particulars such an eye may be of normal composition. When present this indicates an imperfect differentiation of the cornea and sclera at an early period of fœtal life, the cornea, up to a certain time of intra-uterine existence, being as opaque as the sclerotic. In a certain number of cases of irideremia, or absence of the iris, this sclerosis of the cornea is present in the form of an annular opacity involving its periphery. To this appearance Stellwag gave the name *fœtal ring*.

CONGENITAL OPACITIES OF THE CORNEA.—The normal transparency of the cornea may be found at birth to be marred by the presence of milky spots, which may clear up in later life, or by the existence of denser opacities. Finally, congenital staphyloma of the cornea is described. The various forms of corneal opacity which appear as congenital affections resemble like changes occurring after birth as the result of corneal ulceration. In a case which I recently observed in the maternity wards of the Philadelphia Hospital, an oval, dense white, slightly prominent leucoma occupied the lower and outer quadrant of the left cornea. In all other respects the child was normal; the mother was a healthy Irish woman without eye affection and with no infectious vaginal discharge. In like manner, the possibility that that type of keratitis, which is described as interstitial or parenchymatous keratitis, may exceptionally arise *in utero* has been discussed. For example, Dr. R. L. Randolph[1] has reported a congenital clouding of the cornea affecting two sisters, which was looked upon as a congenital form of interstitial keratitis, not differing from the ordinary—or, what he called in contradistinction, the postnatal—form of the disease.

CONGENITAL STAPHYLOMA of the cornea has not been much mentioned by systematic writers. When present, it appears in the form of a true staphyloma; the cornea converted almost in its entire expansion into cicatricial tissue rich in vessels, to which the iris may be attached in its entire circumference, and the whole mass be in high degree prominent and bulging forward. In these cases the anomaly depends not so much upon a malformation or arrest of development as upon a fœtal inflammation of the eye. This, according to Oscar Pincus,[2] takes place in the second half of fœtal life, because all portions of the eye are fully developed. The possibility of a gonorrhœal infection of such cases may not be entirely disregarded, inasmuch as Fuchs has observed perforation of the cornea at birth due to a congenital blenor-

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[1] *Am. Journ. Med. Sci.*, December, 1888.

[2] "Beitrag zur Lehre vom Staphyloma Corneæ congenitum," *Inaug. Dissert.*, Königsberg, 1887.

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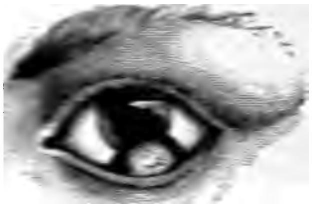

[illegible] scleral [illegible] in the Phila- [illegible]

[illegible] skin. They [illegible] They may [illegible] anomalies, especially [illegible] of the eyeball [illegible] dermoids of the [illegible] Piqué[2] [illegible] dermoid tumors of the cornea and conjunctiva, [illegible] in human eyes. Included among them are the [illegible] of these membranes, the *brides ophthalmiques* of French writers, which stand in close relationship to coloboma of the eyelids, and to which reference has already been made. These dermoids have been ascribed by Van Duyse to the remains of amniotic adhesions, but Piqué thinks rather that they should be looked upon as resulting from the coalescence of the eyelids in such

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[1] *Krankheiten des Auges.*

[2] *Anomalies de Développement et Maladies congénitales du Globe de l'Œil.*

a way that at the moment of separation one lid attracts to itself a portion of the other. This view is based upon the fact that the structure of the growths very often agrees with that of the lid-border. The treatment consists in dissecting away the tumor, which is entirely benign in its nature.

Sometimes a yellowish protrusion exists between the lid and the globe, usually at the outer side of the orbit, which is a *congenital fibro-fatty tumor*.

CONGENITAL ANOMALIES OF THE IRIS.

HETEROPHTHALMOS, or the condition in which the color of one iris is different from that of the other, is probably a peculiarity, in most instances, without pathological significance. This chromatic asymmetry of the iris may appear in the form of differences in color, in shade, or in tone; most unusual is a positive dissimilarity in color. It is necessary to differentiate between discolorations produced by local causes like iritis and those which are of congenital origin. In later life this appearance is, in the opinion of some observers, significant of the neurotic constitution.[1] In an examination of 50 cases of chorea of childhood which I made the symptom was present in 50 per cent. of them.[2]

CORECTOPIA is a term applied to an eccentric position of the pupil, not to be confounded with the cases of true coloboma of the iris presently to be described. The grade of corectopia may vary from a slight increase of the normal eccentric position of the pupil below, and to the inner side, up to those cases in which the whole pupil is displaced out of the centre of the iris toward the border of the cornea. The latter variety is a very unusual phenomenon. *Ectopia*, or this complete shifting of the normal position of the pupil, may naturally have various causes, and is ascribed either to an essential malformation or to the result of a fœtal iritis. Both eyes may be affected symmetrically, and several members of the same family may present this defect.

POLYCORIA, or a multiplicity of pupils, is a rare anomaly. The abnormal pupil or pupils may be situated in the immediate neighborhood of the normal pupil, separated from one another by a narrow band of iris-tissue, or the increased number of pupils may be the result of crossing strands of persisting pupillary membrane.

An opening which exists at the ciliary margin of the iris has been described, and is probably due to a congenital irido-dialysis.

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[1] Féré: *Le Progrès médical*, September 25, 1885.

[2] "An Examination of Fifty Cases of Chorea in Childhood," *New York Medical Journal*, June 23, 1888.

Persistent Pupillary Membrane is an interesting anomaly of not very infrequent occurrence, and results from an incomplete resolution of the membrane which covers the anterior surface of the lens during fœtal life. In which month this membrane, in the human fœtus, makes its appearance has not been definitely ascertained. Authors have variously supposed this to be from the eighth week to the fourth month. In like manner, difference of opinion exists as to what time the membrane disappears. It has usually been supposed to subside in the seventh month, others have described its appearance as late as the end of intra-uterine life, and still others even as late as the first month after birth. The retrograde metamorphosis of the membrane usually consists in the contraction of its vessels, which spread themselves out in the form of arcades, after which the connective-tissue stratum is destroyed. If, however, some remnants remain behind, a pathological picture is the result. From the embryological standpoint, as W. J. Collins[1] observes, it is more proper to regard the pupillary membrane as merely a specialized portion of the capsulo-pupillary covering. Those cases to which the name of pupillary membrane is alone accurately applicable are where threads attached to the iris pass diametrically, or cordwise, across the pupil. Several varieties of the persistence of the pupillary or capsulo-pupillary membrane exist. Usually the fibres proceed from the anterior surface of the iris across the pupil, either singly or in groups of a dozen or more strands. Sometimes the fibres remain separated; sometimes they grow together in front of the anterior capsule, and sometimes they unite in the form of a variously colored plaque adherent to the capsule of the lens. In one instance the remains took on the form of a central white curtain which was suspended by fine threads from the anterior surface of the iris.

Persistent pupillary membrane is more frequently seen in one than in both eyes. The question of heredity has been raised in relation to this disorder, but has by no means been satisfactorily determined.

Capsulo-pupillary tags are not infrequently mistaken for the synechia due to iritis. Indeed, the association of the two has been observed. No difficulty should, however, arise because the normal action of the pupil is not impeded by the presence of these vestigial anomalies. The appearance is often not detected until some other disorder calls for an ophthalmoscopic examination, because vision is not seriously or at all impaired. Oblique illumination will, however, readily demonstrate the remains of the pupillary membrane if present, and is, indeed, the best method in which to study this phenomenon.

Coloboma of the Iris is a fissure of this membrane which, in a general way, resembles an artificial pupil made by the operation of iridectomy. Its occurrence is quite frequent; in fact, it is probably the most usual of the congenital defects of the eye.[1] Fichte, quoted by Manz,[2] among 78 cases of coloboma of the iris found 44 among males and 34 among females. Both eyes are more frequently affected than a single eye; when the defect is unilateral it is the left side, on which the anomaly is usually found. The situation of the fissure is almost invariably directed downward and inward, although Dr. Samuel Theobald[3] reports a case of double congenital irideremia in a child whose mother had congenital coloboma of each iris, and in one eye the coloboma was directed *upward*—a practically unique observation. The coloboma may extend across the whole iris (complete coloboma) or stop at a certain distance from the ciliary margin (incomplete coloboma). In addition the so-called *pseudo-coloboma* is described, which may perhaps be looked upon as a form of heterochromia of the iris, or, according to Mittstädt, as the last remains of the ocular fissure which is tending toward closure, and which appears as a small stripe, somewhat granular, and differentiated from the rest of the iris by its brighter color. In "bridge coloboma" the borders of the cleft are united by a narrow, pigmented or colorless, transverse band of fibres. Coloboma of the iris is frequently associated with similar defects in the choroid, and also with microphthalmos, congenital cataract, and fissures of the eyelids, lip, and palate. Its most probable cause is an arrest of development, the result of incomplete closure of the choroidal fissure, or the fissure of the secondary optic vesicle; hence its situation in the lower and inner quadrant of the iris. Much evidence has been brought to show an hereditary tendency in this defect, and several members of the same family are not infrequently affected. Thus in Streatfield's case[4] two brothers were afflicted with iris coloboma, and one transmitted it to his son and grandsons, seven in all; and in a rare family history of congenital coloboma of the iris De Beck[5] found that seven members had been affected, the anomaly occurring in two generations and passing down two separate branches.

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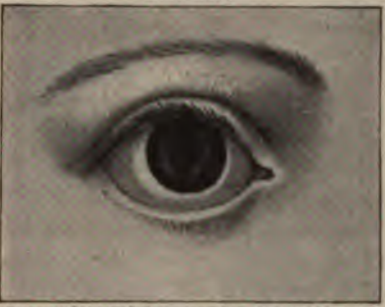
[1] *The Royal London Ophthalmic Hospital Reports*, vol. xii, July, 1888.

FIG. 220.



Incomplete Coloboma of Iris (after Meyer).

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[1] Mooren (*Nagel's Jahresbericht*, 1883, p. 259), however, found coloboma of the eye (iris and choroid) in only 23 instances among more than 100,000 patients.

[2] *Loc. cit.*

[3] *American Ophthalmological Society*, 1888.

[4] *Royal London Ophthalmic Hospital Reports*, vol. i. p. 153.

[5] *Archives of Ophthalmology*, 1886, vol. xv. p. 8.

Irideremia, or congenital absence of the iris, is found both in a partial and a complete form. When the loss is total, a casual observation of the eye makes it appear dark, while closer examination reveals the pupillary field to be really somewhat gray in color, as it is under full dilatation after the use of a mydriatic. Indeed, the appearance resembles in a general way an eye under the influence of complete mydriasis. Some observers have noted a reddish sheen in such eyes. Total congenital irideremia is almost invariably bilateral, only a few cases being on record in which one eye alone was affected. One such case is recorded by Harlan.[1] It is frequently associated with other anomalies of the globe—partial or complete cataract, dislocation of the lens, nystagmus, strabismus, and departures from the normal curvature of the cornea, or with annular opacities in its periphery, the fœtal ring of Stellwag's nomenclature. Congenital absence of the iris, in the majority of instances, shows a marked hereditary tendency. In a collection of 30 cases by A. Laurentjeff,[2] 19 showed this evidence of heredity, while in De Beck's list of congenital colobomas of the iris and cases of irideremia 26 examples furnished evidence of hereditary transmission, 10 of which were direct from the father. Arrested development and intra-uterine disease have been ascribed as causes of irideremia, while Manz has taught that the defect was due to a too late separation of the lens from the anterior wall of the eye, whereby the interposition of the iris between the two was prevented.

Further defects of the iris which may be mentioned are the results of *intra-uterine iritis*, to which reference has already been made, and *intra-uterine atrophy of the iris*, as recorded by Jessop,[3] where the anterior epithelial layer was wanting, although the other structures were perfect, and the so-called *congential ectropium of the uvea*, where a round excrescence is found projecting from the margin of the pupil, bending around to the anterior border. A similar formation is proper to the eye of the horse, and is frequently seen in the cow. Some authorities have looked upon this as a papilloma of the iris, but, as Ancke[4] points out, this is not accurate, for the excrescence is not a neoplasm, but a congenital ectropium of the uvea. Very occasionally congenital *cysts of the iris* have been described; for instance, the case of Noyes,[5] and *nævi*, which appear as small black patches, and have been called "simple melanoma."

Anomalies of the Crystalline Lens.

Congenital Cataract, both in a partial and a complete form, is a somewhat rare affection, where examination of the eyes reveals behind the pupil the white opaque lens, the study of which is greatly facilitated by the instillation of a drop of atropine in order to produce mydriasis. The relative frequency of the affection is attested by the following figures quoted from Lucien Picqué.[1] Galezowski found 7 cases among a total of 551 cataracts during one year. The clinic of Zurich furnished 23 congenital cataracts among a total of 360; and in the tables of De Wecker, among 40,000 cases of various forms of eye disease, 36 total congenital cataracts are enumerated.

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[1] *Trans. College of Physicians, Philada.*

[2] *Abstract Ophthalmic Review*, 1886, p. 10.

[3] *Ophthalmic Review*, vol. vi. p. 22.

[4] *Cent. f. Prakt. Augenh.*, Oct., 1885, p. 311.

[5] *Transactions of the American Ophthalmological Society*, 1880.

A number of theories have been advanced in order to elucidate the etiology of this affection—namely, those which attribute its existence to an inflammation developed during the course of intra-uterine life—an idea which has received some support from the frequent coexistence of coloboma, microphthalmos, and hydrophthalmos—and to the presence of changes in the choroid which have disturbed the nutrition of the eye. Arrest of development and the influence of heredity have received their share in the causation of this affection, in the last particular with much evidence in its favor. Picqué[2] enumerates many instances where members of the same family were attacked; as, for instance, that of Arago, where six persons of one family were subjects of cataract; in one of the branches the mother and three daughters, in the other the mother, grandmother, and granddaughter. In a remarkable instance of heredity in a form of cataract developed in early life, G. A. Berry[3] found, out of 55 individuals belonging to five generations, 20 had cataract—8 males and 12 females. As Berry emphasizes, however, this was a form of cataract developed in early life, and not true congenital cataract, in which variety his experience failed to show the evidence of heredity. Two varieties of congenital cataract which may be mentioned, in contradistinction from the total opacity of the lens just described, are those forms which have received the names of *zonular cataract* and *pyramidal cataract*, a detailed description of which would not be in place in the present essay. Congenital cataracts are frequently and successfully treated by operative interference, but occasionally even after the most perfect operation and the absorption of the opaque lens there is a failure to restore vision, owing to the imperfect development or diseased condition of the deeper structures in the eye.

Partial or complete *luxation of the crystalline lens* occurs as a congenital defect, and its entire absence has been described.

ANOPHTHALMOS, or a complete absence of the eyes, is an affection which, like the other anomalies, is more frequently observed to be double than one-sided. E. T. Collins[4] has collected 12 instances of nilateral anophthalmos, to which Young[1] has added 11 more. A hild born without eyes may be healthy and well developed in other respects, or may be the subject of additional congenital deformities. The palpebral apertures are small, the lids usually deficient in size, sunken, and upon their separation the empty orbit without trace of the globe is revealed.

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[1] *Anomalies de Developpement et Maladies congénitales du Globe de l'Œil*, Paris, 1886.

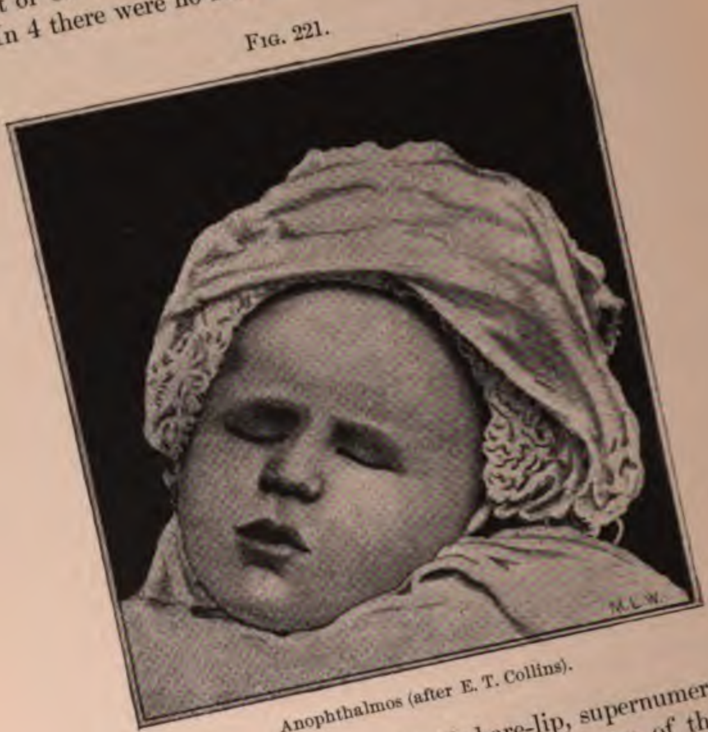
[2] *Loc. cit.*

[3] *Ophthalmic Review*, vol. vii. p. 1, 1888.

[4] *Royal London Ophthalmic Hospital Reports*, vol. ii., 1886 to 1887, p. 429.

In 23 out of 30 cases collected by Collins[2] no other deformities were present. In 4 there were no notes as to other deformities, while in the remaining 4 left-sided hare-lip, double hare-lip, supernumerary fingers, palatine fissure, deformity of the skull, and, in one of the unilateral cases, talipes calcaneum of the right foot, existed. Diverse causes have been invoked to explain the existence of anophthalmos. That which appears to be the most reasonable upon the face of it is, as Collins in his analysis of post-mortems in such cases points out, that no primary optic vesicle has budded out from the anterior primary encephalic vesicle, or, having budded out, has failed to form a secondary opti vesicle—an explanation, however, which does not fit in all cases, inas much as we have the instances of cryptophthalmos and anophthalm associated with the formation of cysts in the lower lid, as recorded

FIG. 221.



Anophthalmos (after E. T. Collins).

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[1] *The Medical News*, June 9, 1889.

[2] *Loc. cit.*

Snell and v. Reuss, where the opening of the cyst disclosed a misplaced rudimentary eyeball. Kroll, quoted by Picqué, has seen bilateral anophthalmos in a newborn child, with ectropium and a purulent secretion of the conjunctiva, which the author explained as the result of a total disorganization of the globe following an intra-uterine blenorrhœa of the conjunctiva. The question as to the primary cause of this abnormality has naturally led to a search for hereditary influence and consanguinity of the parents, but without definite results in the large majority of cases. In 12 of the cases of Collins' collection a maternal impression or fright is mentioned as having occurred during pregnancy; for example, fright during the first month; a child in a fit with its eyes rolled up on the fifteenth day; visiting a blind asylum daily during the whole of pregnancy; seeing a man with one eye during the second month. But if the view taken by this author is correct, that the abnormity is caused by the non-formation of either the primary or secondary optic vesicle, only such impressions as occurred in the very earliest stages of pregnancy could be operative, since commencement of the optic vesicle has been seen in the embryo chick on the fourth day.

CONGENITAL STRABISMUS.—Squint has frequently been stated to be a congenital malformation, but, as Manz insists, in the majority of instances this really develops some time after the birth. The statement, moreover, that in newborn children convergent strabismus is found, as a rule, is not accurate; it is only correct in so far that the axes of the eyes, which in the early fœtal months diverge, later become more and more parallel, so that it appears as if the cornea, owing to the roomy condition of the inner commissure of the eye, was not situated directly in the middle of the palpebral fissure.

Of the anomalies of the external eye-muscles which have been recorded, the most frequent are those due to their abnormal insertion, and even to their entire absence. So, also, we have the instances of congenital paralysis of the eye-muscles and lateral deviations of the eyes. Thus Swanzy[1] observed a case where both eyes turned to the right, and which, when they passed the middle line, developed marked nystagmus. In this case labor had been natural; the eyes were opened on the fourth day, when the nystagmus was first noticed. The cause was supposed to be due to an intra-uterine lesion in the pons implicating the nucleus of the sixth and third pairs. In a similar case observed by Lawford in an adult, examination had revealed absence of the right internal rectus and poor development of the left external rectus. Imperfect development of the eye-muscles, associated with disturbances in the movements of the eye, have been observed in several members of the same family, especially by Heuck and Lawford. Finally, those

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[1] *Ophthalmic Review*, vol. vii. p. 358.

INDEX TO VOLUME II.

A.

Ablepharia, 824
Abnormalities in circulation of infant, 661
Abortion from chorea, 595
  indications for, 195
    mechanical obstruction, 196
    urgent disease, 196
  induction of, 195
Abscess, mammary, 395
Abscesses in puerperal state, 325
Absence of iris congenital, 836
Accidental hemorrhage, 64
Acrania, 652
Acute hæmoglobinuria in infants, 764
Acutest septicæmia, 312
Adenitis following infection, 309
  of areola, 383
Agalactia, 535
Air embolism, 110
Albinism, 840
Albuminuria in puerperal state, 526
Alimentation of infants by tube, 642
Anæmia, puerperal, 472
Anæsthetics for infants, 764
Ankyloblepharon, 823
Anophthalmos, 837
Antisepsis for infants, 764
  dangers of, 340
  for doctors and nurses, 333
  for instruments, 336
  for patients, 332
  hygienic precautions in, 329
  in hospitals, 327
  in obstetrics, 327
  value of, 339
Antiseptic conduct of labor, 347
  intra-uterine injections in, 350
  catheterization in, 354
  cost of, 354
  dressing of patient in, 351
  ergot in, 353
  in private practice, 354
  perineorrhaphy in, 354
  removal of after-birth in, 349
Antiseptics, 344
Anus in infants, 795
    abnormal, 799
    absence of, 797
    contraction of, 796
    imperforate, 796
    operations on, 798
Areola, eczema of, 383
  cellulitis and adenitis of, 383
Atresia oris, 771

B.

Bacteria, causal connection with disease, 416
Basilyst, 170
Basiotribe, 170
Bladder, affections of, in infants, 806
  inflammation of, puerperal, 531
Blindness in puerperal state, 528
Brain, incomplete, 653
Breasts, abscess of, 395
  erysipelas of, 383
  fistulæ of, 399
  inflammation of. (See *Mastitis*, 385.)
  lymphangitis of, 384
Buhl's disease, 761

C.

Cæsarean section, 247
  antisepsis in, 254
  causes of death in, 252
  control of hemorrhage in, 267
  effect of, upon malacosteon subjects, 267
  history of, 247, 263
  indications for, 250
  in savage tribes, 249
  modes of operating, 253
  mortality of, 252
  Müller's modification of, 265
  new methods of performing, 258
  Porro's method, 262
  results of, 268
  risks of, 251
  Sänger's method, 258
    operation after, 259
  Veit's modification of, 266
Caput succedaneum, 85, 678
Carcinoma of corpus and cervix, 484
Cataract, congenital, 836
Catarrhal conjunctivitis in infants, 703
Cellulitis following infection, 309
  of areola, 383
Cephalhæmatoma, 678
Cephalhydrocele, 803
Cephalotribe, application of, 176
Cephalotribes, 168
Cerebral disease as cause of fever, 497
  hemorrhage in puerperal state, 626
Cervix, annular laceration of, 18
  hemorrhage from, 17
  involution of, 467
  laceration of, 17
Chamberlens, the, 122

- **Child. (See also *Infant.*)**
  - **feeding of, by tube, 642**
  - **injuries to, by forceps, 159**
    - **during birth, 84**
    - **of arms, 99**
    - **of the brain, 96**
      - **intracranial hemorrhage, 97**
    - **of the clavicle, 99**
    - **of the cranial bones, 88**
      - **fractures, 89**
    - **of the facial nerves, 94**
      - **paralysis, 94**
    - **of the head and neck, 84**
      - **caput succedaneum, 85**
      - **cephalohæmatoma, 85**
    - **of the lower limbs, 100**
    - **of the scalp and face, 87**
      - **sloughing of scalp, 87**
    - **of the sterno-cleido-mastoid, 94**
    - **of the trunk, 98**
    - **of the vertebræ, 90**
      - **fracture, 93**
    - **paralyses, 100**
      - **treatment of, 101**
- **Chorea in pregnancy and puerperium, 590**
  - **causes of, 591**
  - **complications of, 599**
  - **insanity with, 599**
  - **pathology of, 600**
  - **prognosis of, 603**
  - **symptoms of, 592**
  - **tendency to abortion in, 595**
  - **treatment of, 605**
- **Circulation of infants, anomalies of, 664**
- **Club-foot in infants, 815**
  - **varieties of, 816**
- **Coccygeal tumor, congenital, 805**
- **Cold as cause of fever, 494**
- Coloboma, 821
- Colostrum-corpuscles in milk, 542
- Constipation as cause of fever, 495
  - in infants, 755
    - causes of, 756
      - anal fissure, 757
    - symptoms of, 758
    - treatment of, 758
- Conjunctiva, congenital anomalies of, 828
- Conjunctivitis in infants, 703
  - mild or catarrhal, 703
  - gonorrhœal, 704
- Corectopia, 833
- Cornea, congenital anomalies of, 829
  - congenital opacities of, 831
    - staphyloma, 831
  - hydrophthalmos, 830
  - microphthalmos, 829
  - sclerophthalmia, 831
- Cranioclast, application of, 175
- Cranioclasts, 167
- Craniotomy, 164, 165
  - application of forceps after, 178
  - basilyst for, 170
  - basiotribe for, 170
  - cephalotribe for—
    - Baudelocque's, 168
    - Blob's, 168
    - **Breisky's, 169**
    - **Hicks', 168**
    - **Lusk's, 169**
  - **compared with alternative operations, 189**
  - **cranioclasts for, 167**
  - **frequency of, 187**
  - **indications for, 188**
  - **in face presentations, 177**
  - **instruments for evacuating brain in, 173**
  - **mortality of, 186**
  - **on after-coming head, 177**
  - **perforators in, 165**
  - **resection of head in, 178**
  - **version after, 178**
- **Creolin in obstetrics, 346**
- **Cryptophthalmos, 825**
- **Crystalline lens, anomalies of, 836**
- **Cyanosis in infants, 664**
  - **causes of, 666**
  - **commencement of, 665**
  - **effect of intercurrent diseases on, 670**
  - **etiology of, 675**
  - **heart-action in, 669**
  - **history of, 664**
  - **influence of sex on, 665**
  - **malformations of heart in, 672**
  - **modes of compensation in, 673**
    - **of death in, 671**
  - **morbid anatomy of, 674**
  - **prognosis of, 671**
  - **symptoms of, 666**
  - **temperature in, 668**
  - **treatment of, 677**
- **Cystitis in puerperal state, 531**

D.

- Decapitation, 179
- Degeneration, fatty, acute, in infants, 761
- Delirium tremens after childbirth, 575
- Diarrhœa of infants, 753
  - treatment of, 754
- Digits, congenital union of, 769
  - operations for, 770
- Digits, supernumerary, 767
  - treatment of, 768
  - varieties of, 768
- Diphtheria in infants, 737
  - cases of, 738
  - prevention of, 740
  - treatment of, 737
- Diphtheria, puerperal, 517
- Diseases of mother in labor, 118
- Disinfection, 327
- Dislocations in infants, 814
- Distichiasis, 825

E.

- Eclampsia, 72
  - as cause of fever, 498
  - causes of death in, 75
  - convulsions in, 73
  - course of, 74

Eclampsia, etiology of, 76
    Halbertsma's theory, 78
    Traube-Rosenstein theory, 81
  frequency, 72
  mortality of, 75
  premonitory signs, 72
  prognosis of, 76
  temperature in, 75
  termination of, 75
  treatment of, 81
    obstetric, 84
Eczema of areola, 383
Embolism from air, 110
Embolus in puerperal state, 626
Embryotomy, 163
  in contracted pelvis, 183
  on dead fœtus, 181
    indications for, 181
  on fœtal monstrosities, 184
  on living fœtus, 184
    indications for, 185
Emotion as cause of fever, 491
Encephalocele, 656, 802
Endocarditis following puerperal infection, 323
Endometritis from infection, 306
Endometrium, involution of, 465
Epicanthus, 826
Epilepsy in puerperal state, 622
Erysipelas in puerperal state, 511
  of breasts, 383
Erythema in puerperal state, 509
Exanthemata in puerperal state, 506
Eye, congenital anomalies of, 821
  dermoid tumors of, 832
Eyelashes, congenital abnormalities of, 825
Eyelids, absence of, 824
  anomalies of, 821
Eyes, absence of, 837
  congenital pigmentation of, 840

F.

Fatty degeneration in infants, acute, 761
Feeding infants by tube, 642
Fevers from cerebral disease, 497
  from constipation, 495
  from emotion, 491
    causes of, 492
  from exposure to cold, 494
  from insolation, 498
  from reflex irritation, 496
  from syphilis, 499
  non-infectious, 491
  persistence of, in puerperal state, 507
  with eclampsia, 498
Fibrinous polyp, 478
Fibroids of uterus, 483
Fissured palate, 780
Fistulæ of breasts, 399
Fœtus, operations destructive to, 163
Forceps, 121
  accidents accompanying use of, 160
  after version, 243
  application of the, 136
Forceps, application of the, at the inferior strait, 138
    at the superior strait, 144
    frequency, 160
    in contracted pelves, 152
    in face presentations, 142
    in occipito-anterior positions, 138
    in occipito-posterior positions, 141
    injuries by, to child, 159
    morbidity of, 157
    mortality of, to fœtus, 158
      to mother, 157
    of axis traction, 149
    position of patient for, 136
    to abnormally small fœtus, 151
    to after-coming head, 155
    to the breech, 143
    to the severed head, 156
    when head and birth-canal are disproportionate in size, 150
    when head and birth-canal are proportionate in size, 138
    with the head oblique, 139
  axis-traction, 125, 127, 128, 134
  axis-traction with, 146
  Breus', 130
  Brunninghausen's, 126
  Chamberlen's, 124
  conditions justifying employment of, 135
  Elliot's, 132
  exceptional functions of, 156
  function of, 134
  high application of, 144
  history of, 121
    in America, 127
  Hodge's, 131
  Hubert's, 127
  indications for use of, 134
  Levret's, 125
  modern, 128
  Naegele's, 129
  Palfyn's, 123
  Poullet's, 133
  Rothlaw's, 124
  Rueff's, 121
  Sawyer's, 133
  Simpson's, 129
  Smellie's, 125
  Smith's, 132
  Stevenson's, 134
  Tarnier's, 127
  Wallace's, 131
Fractures in infants, 814

G.

Galactorrhœa, 539
  treatment of, 539
Gavage, 643
Glycosuria in puerperal state, 526
Gonorrhœa in puerperal state, 521
Gonorrhœal conjunctivitis in infants, 704

H.

Hæmatoma, puerperal, 485

Hæmaturia in puerperal state, 534
Hæmoglobinuria, acute, 764
Hare-lip, 772
  method of operating for, 774
  period of operating for, 778
Head, resection of fetal, 178
Heart disease in labor, 107, 118
    frequency of —
    mitral stenosis, 119
  displacement of, in infants, 661
  inflammation of, from puerperal infection, 323
  malformations of, in infant, 662
Hemorrhage, accidental, 64
    symptoms of, 65
    treatment of, 65
  cerebral, in puerperal state, 626
  during labor, 45
  post-partum, 66
    symptoms of, 67
    treatment of, 67
      auto-infusion, 70
      cold, 69
      compression of uterus, 68
      heat, 69
      iron salts, 69
      tamponing uterus, 70
      transfusion, 70
      vinegar, 69
  puerperal, 475
  secondary, 71
    causes of, 71
    treatment of, 71
  umbilical, in infants, 719
Hernia in infants, 809
  encysted, 810
  inguinal, congenital, 810
  into funicular process, 811
  scrotal, 810
    treatment of, 811
  trusses, selection of, 811
    umbilical, 812
    varieties of, 810
Heterophthalmos, 833
Hospitals, obstetrical antisepsis in, 327
  disinfection of, 331
    doctors and nurses, 333
    instruments, 336
    materials, 336
    patients, 332
    sutures and ligatures, 337
    wards, 331
Hydrencephalocele, 806
Hydrocele, encysted, 811
Hydrocephalus, 800
Hydrophthalmos, 830
Hyperlactation, 538
Hypertrophy of alveolar process, 781

I.

Icterus neonatorum, 711
    frequency of, 715
    prognosis of, 716
    theories of causation, 712
    treatment of, 716
Incontinence of urine in puerperal state, 532
Induction of abortion, 167
Infant, injuries to, by forceps, 158
  injuries to, during birth, 82
    of arms, 99
    of the brain, 96
      intracranial hemorrhage, 97
    of the clavicle, 99
    of the cranial bones, 89
      fractures, 89
    of the facial nerve, 94
      paralysis, 94
    of the head and neck, 86
      caput succedaneum, 87
      cephalhæmatoma, 87
    of the lower limbs, 100
    of the scalp and face, 87
      sloughing of scalp, 87
    of the sterno-cleido-mastoid, 92
    of the trunk, 98
    of the vertebra, 90
      fracture, 90
    paralyses, 100
      treatment of, 102
Infants, absence of tongue in, 787
  acute fatty degeneration of organs in, 761
  acute hæmoglobinuria in, 764
  anomalies of eyelids in, 822
  anus in, 795
  artificial feeding of, 636
  bathing of, 644
  Buhl's disease in, 761
  care of, 633
  clothing of, 645
  club-feet in, 815
  congenital anomalies of circulation in, 661
    anomalies of eye in, 821
    union of digits in, 769
  conjunctivitis in, 707
  constipation in, 757
  cyanosis in, 664
  diarrhœa in, 756
  diphtheria in, 777
  dislocations in, 624
  displacement of heart in, 661
  exercise of, 647
  feeding of, 634
  fissured palate in, 780
  forced feeding of, 642
  fractures in, 814
  hæmatemesis in, 748
  hare-lip in, 772
  hernia in, 809
  hydrocephalus in, 800
  icterus in, 711
  intestinal obstruction in, 784
  intussusception in, 786
  malformations of, 649
    of heart in, 662
  mammary glands of, 681
  mastitis in, 399, 681
  melæna in, 748
  nose, diseases of, in, 805

Infants, ophthalmia in, 704
  phimosis in, 808
  quantity of food consumed by, 635
  scleroma in, 762
  sepsis of, 724
  sleep of, 647
  supernumerary digits in, 767
  surgery of, 763
    anæsthetics in, 764
    antisepsis in, 764
  tetanus in, 682
  thrush in, 742
  tongue-tie in, 782
  umbilical hemorrhage in, 719
    hernia in, 812
    vegetations in, 717
  urinary bladder in, 806
  Winckel's disease in, 761
Injuries, influence of, on temperature, 474
  of perineum, 33
  of vagina, 28
  of vulva, 31
    repair of, 473
  to the child during birth, 84. (See also under *Child* and *Infant.*)
Insanity, influence of childbearing on, 584
  causes of, 552
    anæmia, 559
    classification of, 555
    illegitimacy as a, 558
    septic infection, 560
  diagnosis of, 574
    from delirium tremens, 575
  frequency of, 549
  history of, 546
  infanticide during, 587
  insomnia in, 570
  medico-legal aspects, 585
  pathology of, 577
  prognosis of, 576
  puerperal, 545
  symptoms of, 563
  treatment of, 579
  varieties of, 564
    relative frequency of, 565
  with chorea in pregnancy and the puerperium, 599
Insolation as cause of fever, 498
Insomnia in puerperal insanity, 570
Intestinal obstruction in infants, 784
Intra-uterine injections, 350
Intussusception in infants, 786
    at ilio-cæcal valve, 788
Inversion of the uterus, 40
Involution, 462
  of cervix, 467
  of endometrium, 465
  of lower uterine segment, 467
  of uterus, 462
  of vagina, 467
Iodoform after labor, 338
Irideremia, 836
Iris, coloboma of, 834
  congenital anomalies of, 833
Ischuria in the puerperal state, 529

K.

Kidneys in puerperal state, 529

L.

Labor, antiseptic conduct of, 347
  diseases of mother in, 118
  heart disease, 118
  mortality of, 355
  premature induction of, 194
  sudden death in, 104
    from accidents of labor, 109
    from air embolism, 110
    from emotion, 105
    from heart-clot, 113
    from heart disease, 107
    from pulmonary disease, 112
    from pulmonary thrombosis, 110
    from rupture of aorta, 109
    from rupture of spleen, 109
    from ruptured ovarian vein, 113
    from severe suffering, 107
    from syncope, 113
    prevention of, 114
Lacerations of cervix, 17
  of uterus, 17
Lachrymal apparatus, congenital anomalies of, 828
Laparo-cystectomy, puerperal, 268
Laparo-elytrotomy, 281
  history of, 282
  method of operating, 285
  statistical record of, 288
Laparo-hystero-oöphorectomy, 262
Laparo-hysterotomy, 258
Laparotomy for puerperal infection, 373
Larynx, growths in, in infants, 806
Lens, crystalline anomalies of, 836
Leucomaïnes, 446
Lochia, micro-organisms in, 430
  microscopical appearance of, 466
Lubricants in obstetrics, 348
Lymphangitis following infection, 309
  of breasts, 384

M.

Macrostoma, 771
Malaria, puerperal, 517
    diagnosis of, 518
    treatment of, 519
Malformations of heart in infants, 662
  of infants, 649
    maternal impressions in, 630
Mammary abscess, 395
  chronic, 398
  gland, atrophy of, 536
  glands of infants, 681
Mania. (See *Insanity.*)
Mastitis, 385
  causes of, 386
    stasis of milk, 388
  of the newborn, 399
  symptoms of, 389
    in glandular variety, 389.
    in subcutaneous variety, 389

[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
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preparation of, for infants [illegible]
[illegible]
secretion, abnormalities of, [illegible]
qualitative, [illegible]
quantitative, [illegible]
influence of diet on, [illegible]
of menses on, [illegible]
[illegible]
[illegible]
[illegible]
[illegible]

N.

[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]

O.

[illegible] 784
[illegible]
[illegible]
[illegible] puerperal infection
[illegible]
neonatorum, 704
course of, 706
infectious principle in, 704
prevention of, 707
results of, 706
symptoms of, 705
treatment of, 709
Operations destructive to fetus, 163
indications for, 164
for hare-lip, 772
Operations [illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]

P.

[illegible]
[illegible]
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[illegible]
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[illegible]
[illegible]
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[illegible]
Peritonitis following infection, [illegible]
Persistent pupillary membrane, [illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
Placenta prævia, [illegible]
[illegible]
causes of, [illegible]
definition of, [illegible]
diagnosis of, [illegible]
frequency of, [illegible]
hemorrhage in, [illegible]
explanation of, 52
origin of, [illegible]
prognosis of, 54
symptoms of, 50
treatment of, 54
Barnes' method, 61
Hicks' method, 58
Murphy's method, 57
tampon in, 59
Wigand's method, 60
varieties of, 50
Pleurisy following infection, 31 [illegible]
in puerperal state, 505
Pneumonia following puerperal infection, 320

- Pneumonia in puerperal state, 502
  - cases of, 504
  - prognosis of, 503
  - treatment of, 503
- Polycoria, 833
- Polygalactia, 538
- Polyp, fibrinous, 478
- Porro-Cæsarean section, 262
- Post-mortem Cæsarean section, 116
  - delivery, 115
- Post-partum hemorrhage, 66
- Premature induction of labor, 194
  - aspiration of uterus in, 207
  - Barnes' plan for, 208
  - bougie in, 203
  - colpeurynter in, 205
  - electricity in, 207
  - history of, 194
  - indications for, 197
  - mechanical dilatation of cervix in, 206
  - operation, 203
    - Braun's method, 205
    - Cohen's method, 204
    - Kiwisch's method, 204
    - Krause's method, 203
    - Scheel's method, 203
    - Tarnier's method, 206
  - prognosis of, 200
    - compared with alternative operations, 202
    - for child, 201
    - for mother, 200
  - puncture of membranes in, 203
  - time for operating, 199
  - uterine injection in, 204
  - vaginal douche in, 204
- Pressure-palsies following labor, 629
- Ptomaïnes, 444, 447
  - origin of, 449
  - physiological action of, 450
- Ptosis, congenital, 821
- Puerperal albuminuria, 526
  - anæmia, 472
  - blindness, 528
  - cystitis, 531
  - diphtheria, 517
  - embolus, 620
  - epilepsy, 622
  - erysipelas, 511
    - diagnosis of, 516
    - frequency of, 516
    - origin of, 516
    - relation of, to septic infection, 513
    - symptoms of, 516
  - exanthemata, 506
  - gonorrhœa, 521
  - fever. (See *Puerperal Infection*, 290.)
    - bacteria in, 406
      - methods of discovering, 407
    - bibliography of, 454
    - classification of, 511
    - contagiousness of, 403
    - etiology of, 401
    - micro-organisms discovered in, 428
    - modes of infection in, 422
    - ptomaïnes in, 444
- Puerperal fever, pyæmia in relation to, 409
    - relation of infectious diseases to, 511
    - septicæmia in relation to, 409
    - hæmatoma, 485
    - clinical history of, 487
    - diagnosis of, 487
    - etiology of, 486
    - frequency of, 485
    - prognosis of, 489
    - situation of, 486
    - size and form of, 486
    - terminations of, 488
    - treatment of, 490
  - hemorrhage, 475
    - from carcinoma, 484
    - from dislodgment of clots, 481
    - from displacement of uterus, 479
    - from emotional causes, 482
    - from fibroids, 483
    - from pelvic engorgement, 483
    - from relaxation of the uterus, 482
    - from retained secundines, 475
    - from retention of blood-clots, 483
    - from ruptured hæmatomata, 483
    - from wounds, 484
  - infection, 290
    - adenitis following, 309
    - arthritis in, 312
    - Barker's theory of, 294
    - bed-sores in, 377
    - cellulitis and adenitis, 315
      - diagnosis, 316
      - prognosis, 316
    - cellulitis following, 309
    - conveyance of poison in, 304
    - curative treatment of, 361
      - antipyretics in, 371
      - cauterization of ulcers, 363
      - curette in, 364
      - injections in, 363
      - iodine in, 367
      - iodoform in, 363
      - intra-uterine applications in, 365
      - laparotomy, 373
      - remedies for peritonitis in, 368
    - defective hygiene as cause of, 302
    - endocarditis following, 323
    - endometritis and metritis, 315
      - diagnosis, 315
      - prognosis, 315
    - endometritis following, 306
    - entrance of poisons in, 303
    - etiology of, 297
    - heart in, 311
    - historical sketch of, 293
    - liver in, 311
    - lymphangitis, 309, 316
    - metritis following, 307
    - microbes in, 290, 432
    - nature of disease, 293
    - oöphoritis following, 308
    - ophthalmia in, 311
    - pathology of, 305
    - pericarditis following, 310
    - peritonitis following, 317

- Puerperal infection, peritonitis in, 317
    - general, 319
    - local, 317
    - prognosis, 318
  - phlebitis following, 310
  - pleurisy following, 310
  - pneumonia in, 320
  - predisposing causes of, 297
  - prevention of, 327
  - salpingitis following, 308
  - Semmelweiss' discoveries in, 301
  - sources of, 299
  - spleen in, 311
  - suppuration as cause of, 300
  - time of, 305
  - vaginitis following, 305
  - vomiting in, 376
  - vulvitis and vaginitis in, 313
    - diagnosis, 314
    - prognosis, 314
    - symptoms, 313
  - vulvitis following, 305
  - zymotic diseases in relation with, 303
- insanity, 345
- laparo-cystectomy, 208
- malaria, 517
- neuroses, 590
- peptonuria, 527
- state, acute intercurrent diseases in, 502
  - albuminuria in, 526
  - alimentary canal in, 324
  - arthritis in, 325
  - blindness in, 528
  - cerebral hemorrhage in, 626
  - cystitis in, 531
  - diastasis of abdominal muscles in, 524
  - embolus in, 626
  - epilepsy in, 622
  - erythema in, 510
  - exanthemata in, 506
  - flatulence in, 524
  - glycosuria in, 526
  - gonorrhœa in, 521
  - hæmaturia in, 534
  - incontinence of urine in, 530
  - insanity in, 545
  - ischuria in, 529
    - preventive treatment of, 530
  - kidneys in, 529
  - liver in, 324
  - measles in, 510
  - nephritis in, 324
  - nervous disturbances in, 324
  - non-infectious fevers in, 491
  - peptonuria in, 527
  - phthisis in, 501
  - pleurisy in, 505
  - pneumonia in, 502
  - pressure-palsies in, 629
  - pyelonephritis in, 532
  - rheumatism in, 579
  - scarlet fever in, 506
  - skin diseases in, 325, 523
  - smallpox in, 511
  - spleen in, 324
  - tetanus in, 608
- Puerperal state, tetany in, 621
    - urine in, 525
- Puerperium, occasional neuroses in, 590
- Pulmonary thrombosis, 110
- Pyæmia, etiology of, 410
  - lesions of, 423
- Pyelonephritis in puerperal state, 532
- Pyogenic micro-organisms, 412

R.

- Rectum of infants, 790
    - absence of, 791
    - imperforate, 791
    - operations on, 792
    - polypus of, 794
- Reflex irritation as cause of fever, 496
- Relaxation of pelvic joints, 543
- Renal diseases in puerperal state, 529
- Resection of fœtal head, 178
  - of fœtal trunk, 178
- Retained blood-clots, 483
- Retained membranes, 476
  - frequency, 476
- Retained placenta, 475
  - cause of, 476
  - diagnosis of, 477
  - frequency, 476
  - treatment of, 478
- Retention of urine in puerperal state, 529
- Rheumatism in puerperal state, 519
    - articular, 520
      - prognosis of, 520
      - treatment of, 521
    - muscular, 521
- Rupture of spleen in labor, 109

S.

- Salpingitis following infection, 308
- Scarlet fever in puerperal state, 506
  - frequency of, 506
  - infection of, 507
  - peculiarities of, 508
  - period of incubation in, 507
  - prognosis of, 509
  - symptoms of, 507
- Scleroma neonatorum, 762
- Sclerophthalmia, 831
- Sepsis of newborn, 724
  - cases of, 725
  - infection of umbilical vein in, 730
    - by other channels in, 735
    - of umbilical lymphatics in, 724
- Septicæmia, acutest, 312
  - after childbirth. (See *Puerperal Infection.*)
  - etiology of, 410
  - lesions of, 423
- Skin diseases in puerperal state, 523
- Sleep of infants, 647
- Smallpox in puerperal state, 511
- Spina bifida, 804
  - diagnosis of, 658
  - prognosis of, 659
  - treatment of, 659

Stenosis, mitral, in labor, 119
Sterno-cleido-mastoid muscle, inflammation of, 679
    prognosis of, 680
Strabismus, congenital, 839
Subinvolution, 462
Sudden death in labor, 104
Sunstroke as a cause of fevers, 498
Superinvolution, 461
Suppuration, chemical cause of, 414
  microbes in, 412
Surgery of infants, 763
Symblepharon, 823
Symphysiotomy, 270
  causes of death after, 279
  distribution of cases, 275
  falcetta for, 275
  history of, 270
  method of operating, 279
  mortality of, 276
Syncope after labor, 113
Syphilis as cause of fever, 499

T.

Tetanus in puerperal state, 608
    causes of, 613
    diagnosis of, 617
    history of, 608
    medico-legal aspects of, 612
    pathology of, 815
    prognosis of, 619
    treatment of, 620
  neonatorum, 682
    cases of, 683
    causes of, 686
    diagnosis of, 700
    duration of, 699
    mode of death in, 698
    morbid anatomy of, 694
    period of commencement, 684
    pregnancy, 684
    preventive treatment of, 700
    prognosis of, 698
    symptoms of, 696
    treatment of, 701
Tetany in puerperal state, 621
Thrush in infants, 742
  causes of, 742
  diagnosis of, 746
  pathology of, 743
  prognosis of, 746
  symptoms of, 745
  treatment of, 747
Tongue, absence of, 781
  congenital hypertrophy of, 782
  -tie, 782
  vascular tumor of, 783
Treatment of chorea in pregnancy and the puerperium, 605
  of constipation in infants, 758
  of cyanosis in infants, 677
  of diarrhœa in infants, 753
  of displacement of uterus, 481
  of eclampsia, 81
  of galactorrhœa, 539
Treatment of hernia in infants, 813
  of icterus neonatorum, 716
  of inflammation of breast, 392
  of injuries of vagina, 30
    of vulva, 32
  of inversion of uterus, 46
  of lacerations of perineum, 38
    of uterus, 26
  of malaria, puerperal, 517
  of mastitis, 392
  of melæna neonatorum, 748
  of meningocele, 802
  of obstetrical fractures, 101
    palsies, 101
  of ophthalmia neonatorum, 709
  of placenta prævia, 54
  of pneumonia following puerperal infection, 503
  of post-partum hemorrhage, 67
  of puerperal hæmatoma, 490
  of puerperal infection, 327
    curative, 361
  of puerperal insanity, 579
  of puerperal rheumatism, 519
  of relaxation of pelvic joints, 543
  of retained placenta, 478
  of secondary hemorrhage, 71
  of sore nipples, 380
  of spina bifida, 659
  of subinvolution of uterus, 471
  of tetanus in puerperal state, 620
    neonatorum, 700, 701
  of thrush in infants, 747
  of umbilical hemorrhage, 766
    in children, 723
  of vegetations in infants, 719
  preventive, of ischuria in puerperal state, 529
Truss for infantile hernia, selection of, 811
Tumor, coccygeal, congenital, 805
Tumors of eye, 832
  of orbit, congenital, 840
    pulsating, vascular, 770

U.

Umbilical hemorrhage in infants, 719
    causes of, 720
      syphilis, 722
    prognosis of, 723
    treatment of, 723
  hernia in infants, 812
    treatment of, 813
  vegetations in infants, 717
    histology of, 718
    progress of, 718
    treatment of, 719
Umbilicus, hemorrhage from, 765
  treatment of, 766
Urinary bladder in infants, 806
    extrophy of, 807
Urine in puerperal state, 525
  retention of, in puerperal state, 529
Uterine muscle-fibres, 464
    fatty degeneration of, 403
Uterus, displacement of, 479

Uterus, displacement of, causes of, 480
    diagnosis of, 481
    treatment of, 481
  fibroids of, 483
  inflammation of, from infection, 306
  inversion of, 40–48
    causes of, 42
    classification of, 44
    degrees of, 41
    diagnosis of, 45
    prognosis of, 46
    symptoms of, 45
    treatment of, 46
  involution of, 462
  lacerations of, 17
    causes of, 22
    complications of, 24
    degrees of, 24
    direction of, 24
    mortality of, 25
    symptoms of, 25
    treatment of, 26
  phthisis of, in puerperal state, 322
  relaxation of, 482
  rupture of body, 20
  rupture of neck and body, 20
  subinvolution of, 462
    causes of, 468
    diagnosis of, 470
    treatment of, 471
  spontaneous rupture of, 21
  superinvolution of, 461
    frequency of, 461
  transverse laceration of, 19
  traumatic rupture of, 21
    frequency of, 21

V.

Vagina, injuries of the, 28
    situations of, 29
      lower portion, 38
      middle, 29
      vault, 28
    symptoms of, 29
    treatment of, 30
  involution of, 467
Vaginitis from infection, 305
Vectis, 161
Vegetations, umbilical, in infants, 717
Version, 209
  Braxton Hicks' method, 223
  capping of fundus in, 229
  cephalic, 212
    contraindications to, 213
    indications for, 212
    methods, 214
Version, combined, 217
    Hicks' method, 217
    method of performance, 222
  complications of, 229
  definition of, 209
  difficulties and dangers of, 229
  external, 215
  extraction in, 232
    anæsthesia in, 232
    liberation of arms in, 234
    of trunk, 233
    position of patient for, 232
  extraction of head after, 236
    Chailly-Honoré's method, 239
    forceps in, 241
    Prague method, 238
    Smellie's method, 236
    Veit-Smellie's method, 237
    Wigand-Martin method, 240
  fillet-bearer for, 227
  fillet in, 226
  forceps after, 243
  history of, 209
  impaction of shoulder in, 232
  internal, 223
  methods of operating, 222
  nomenclature of, 211
  obstructed cervix complicating, 230
  œdema of vulva complicating, 230
  pelvic, 218
  podalic, 218
    choice of hands in, 220
    essential condition for performance of, 218
    history of, 210
    indications for, 218
    position of patient for, 219
    preliminary details, 219
    prognosis of, 219
  prolapse of the arm in, 231
  tetanus uteri complicating, 230
Version vs. forceps, 244
Vomiting of blood by infants, 748
Vulva, injuries of, 31
    treatment, 32
Vulvitis from infection, 305

W.

Winckel's disease, 761
Womb, fibroids of, 483
  inflammation of, from infection, 306
  inversion of, 40
  involution of, 462
  lacerations of, 17
  phlebitis of, in puerperal state, 322
Wounds in genital tract, 484

GENERAL INDEX.

(To the System of Obstetrics.)

A.

Abdominal muscles, diastasis of, in puerperal state, ii. 524
Abnormal presentations, i. 755
Abortion, i. 302
  artificial, i. 49
  induction of, i. 24, ii. 194
Abscess of breasts, ii. 399
Accidents and diseases of labor, ii. 17
Acute and chronic diseases in pregnancy, i. 446
Albuminuria in pregnancy, i. 429
Alimentary disorders in pregnancy, i. 409
Amnion, abnormalities of, i. 225
Anæmia, pernicious, in pregnancy, i. 399
Anæsthetics in labor, i. 635
  use of, in labor, i. 635
  ether, use of, in labor, i. 689
Anomalies of amnion, i. 225
  of fœtus, i. 295
    in labor, i. 653
  of forces in labor, i. 693
  of heart in infants, ii. 661
  of pelvis, i. 719
  of placenta, i. 242
  of soft parts in labor, i. 704
  of umbilical cord, i. 253
Antisepsis in obstetrics, ii. 327
  obstetrical, i. 22, i. 497
Appendages, fœtal, anomalies and diseases of, i. 221
Artificial abortion, i. 49
Asphyxia neonatorum, i. 513
Auscultation, obstetrical, i. 378

B.

Ballottement, i. 372
Bathing in pregnancy, i. 394
Birth, precipitate, i. 694
Blood in pregnancy, alterations of, i. 397
Breasts, abscess in, ii. 395
  diseases of, ii. 379
  fistulæ of, ii. 399
  inflammation of, in infants, ii. 681, ii. 385
Breech presentations, i. 606

C.

Cæsarean operation, ii. 247
Caput succedaneum, ii. 678
Care of infants, ii. 633
Caul, i. 489
Cephalhæmatoma, ii. 678
Cerebral hemorrhage in puerperal state, ii. 626
Children, affections of. (See under *Infants.*)
Chorea in puerperal state, ii. 590
Chorion, diseases of, i. 232
Circulatory diseases of pregnancy, i. 399
  disturbances in pregnancy, i. 407
Complications of puerperal state, non-infectious, ii. 461
Conception, i. 95
Conduct of labor, i. 493
Conjunctivitis in infants, ii. 703
Constipation in infants, ii. 755
Cord, umbilical, i. 130
    prolapse of, i. 794
    shortness, i. 789
Cyanosis, ii. 664
  in infants, ii. 664

D.

Death in labor, sudden, ii. 104
  of fœtus, i. 286
Decidua, diseases of, i. 257
Development of fœtus, i. 201
  of organs, i. 140
  of ovum, i. 101
  of placenta, i. 135
Diagnosis of pregnancy, i. 358
Diarrhœa in infants, ii. 753
Diphtheria in infants, ii. 737
Diseases and accidents of labor, ii. 17
  of breasts, ii. 379
  of decidua, i. 257
  of fœtus, i. 264
  of infants, medical, ii. 629
    surgical, ii. 763
  of placenta, i. 242
  of skin in puerperal state, ii. 523
  of urinary system in puerperal state, ii. 525
Displacements of womb in pregnancy i. 457
Dystocia, i. 755

E.

Eclampsia, ii. 72
Embolus in puerperal state, ii. 626

Embryology, i. 68
Embryotomy, ii. 163
Epilepsy in pregnancy, i. 445
  in puerperal state, ii. 622
Episiotomy, i. 573
Erysipelas in puerperal state, ii. 513
Ether, use of, in labor, i. 659
Etiology of puerperal fever, ii. 401.
Exanthemata in puerperal state, ii. 506
Exencephalia, i. 766
Extra-uterine gestation obstructing labor, i. 717
Eye of infants, diseases of, ii. 704
Eyes, congenital anomalies of, in infants, ii. 821

F.

Face presentations, i. 592
Fertilization, i. 77
Fever, puerperal, etiology of, ii. 401
Fevers, non-infectious, in puerperal state, ii. 491
Fistulæ of breasts, ii. 399
Flatulence in puerperal state, ii. 524
Fœtal appendages, anomalies and diseases of, i. 221
Fœtation, multiple, i. 218
Fœtus, the, i. 555
  abnormalities of, i. 295
  anomalies of, in labor, i. 753
  death of, i. 286
  development of, i. 201
  diseases of, i. 264
  maternal influence on, i. 281
  mature, i. 213
  physiology and pathology of, i. 201
  traumatism in, i. 280
Forceps, ii. 525
Forces in labor, anomalies of, i. 693

G.

Gastro-elytrotomy, i. 49
Gestation, extra-uterine, as an obstruction to labor, i. 717.
Gingivitis in pregnancy, i. 424
Goitre in pregnancy, i. 404
Gonorrhœa in puerperal state, ii. 521

H.

Hæmatoma in puerperal state, ii. 485
Hæmaturia in puerperal state, ii. 534
Hæmophilia in pregnancy, i. 399
Hemorrhage after labor, ii. 66
  cerebral, in puerperal state, ii. 626
  during labor, ii. 48
  in puerperal state, ii. 475
  umbilical, in infants, ii. 719
Hemorrhoids in pregnancy, i. 403
Hernias in infants, ii. 809
History of obstetrics, i. 17.
Hydrocephalus, i. 761
Hygiene of pregnancy, i. 393

I.

Icterus neonatorum, ii. 711
Induction of labor, premature, ii. 194
Inertia uteri, i. 694
Infants, anomalies of eyes in, ii. 821
  asphyxia of, i. 513
  caput succedaneum, ii. 678
  care of, ii. 633
  cephalhæmatoma, ii. 678
  conjunctivitis in, ii. 703
  constipation in, ii. 755
  cyanosis in, ii. 664
  diarrhœa in, ii. 753
  diphtheria in, ii. 737
  diseases of eyes of, ii. 704
    of newborn, ii. 629
  heart, anomalies of, ii. 661
  hernias in, ii. 809
  icterus in, ii. 711
  malformations of, ii. 649
  management and diseases of, ii. 633
  mastitis in, ii. 681
  medical diseases of, ii. 629
  melæna neonatorum, ii. 748
  ophthalmia in, ii. 704
  sepsis in, ii. 724
  septic affections of, ii. 724
  spina bifida, ii. 657, 804
  surgical diseases and treatment of, ii. 763
  tetanus in, ii. 682
  thrush in, ii. 742
  umbilical hemorrhage in, ii. 719
  vegetations in, ii. 717
Infection, puerperal, ii. 290
Infectious diseases of pregnancy, acute, ii. 447
Inflammation of breast in infants, ii. 681
Injuries of fœtus, i. 280
  to child during labor, ii. 84
Insanity in puerperal state, ii. 545
Intestinal diseases in infants, ii. 753
Inversion of uterus, ii. 40
Involution of uterus, anomalous, ii. 401

K.

Karyokinesis, i. 77
Kidneys, diseases of, in pregnancy, i. 429, 435

L.

Labor, accidents and diseases of, ii. 17
  anæsthetics in, i. 635
  anomalies of forces in, i. 693
    of soft parts in, i. 704
  conduct of, i. 493
  mechanism of, i. 543
    of third stage of, i. 628
  physiological and clinical phenomena of, i. 479
  premature, i. 302
    induction of, ii. 194
  sudden death in, ii. 104
Lacerations of the birth-canal, ii. 17

Lactation, i. 525, 537
Laparo-cystectomy, ii. 268
Laparo-elytrotomy, ii. 281
Leucorrhœa in pregnancy, i. 475
Lineæ albicantes, i. 356
Liquor amnii, i. 223
Lochia, i. 523

M.

Malaria in puerperal state, ii. 517
Malformations of infants, ii. 649
Mammary abscess, ii. 395
  fistulæ, ii. 399
Management and diseases of infants, ii. 629
  of the puerperal state, i. 519
Mastitis, ii. 385
  in infants, ii. 681
Maternal influence on fœtus, i. 281
Measles in pregnancy, i. 449
Mechanism of labor, i. 543
  of third stage of labor, i. 628
Melæna neonatorum, ii. 748
Menstruation, i. 82
Milk, anomalous secretion of, ii. 534
  secretion of, i. 525, 537
Miscarriage, i. 302, 315
Monstrosities, i. 295
  fœtal, i. 298
Multiparity, i. 391
Mycosis in pregnancy, i. 477

N.

Nervous diseases in pregnancy, i. 445
Neuroses in pregnancy, i. 445
  in puerperal state, ii. 590
Nipples, care of, i. 532
Non-infectious fevers in puerperal state, ii. 491
Nursing, i. 525, 537

O.

Obstetrics, history of, i. 17
Œdema in pregnancy, i. 397
Ophthalmia in infants, ii. 704
Organs, development of, i. 140
Ovulation, i. 68
Ovum, development of, i. 101

P.

Palsies from pressure in puerperal state, ii. 629
Pathology of fœtus, i. 201
  of pregnancy, i. 396
Pelvic joints, relaxation of, ii. 543
Pelvimetry, i. 725
Pelvis, i. 543
  anomalies of, i. 719
  deformities of, i. 731
Perineum, i. 553
Pernicious anæmia in pregnancy, i. 398
Physiology of fœtus, i. 201
Physiology of labor, i. 479.
  of pregnancy, i. 323
  of the puerperal state, i. 519
Placenta, i. 135
  anomalies and diseases of, i. 242
  degenerations of, i. 243
  delivery of, i. 491, 628
  development of, i. 135
  diseases of, i. 242
  functions of, i. 241
  prævia, ii. 48
Pneumonia in puerperal state, ii. 502
Podalic version, i. 31
Porro operation, i. 56
Pregnancy, acute and chronic diseases in, i. 446
  acute infectious diseases in, i. 447
  alterations of blood in, i. 397
  anomalies in, i. 475
    of vagina in, i. 475
  circulatory disturbances in, i. 407
  diagnosis of, i. 358
  diseases of kidneys in, i. 435
  disorders of alimentary canal in, i. 409
  displacements of womb in, i. 457
  hygiene of, i. 393
  neuroses in, i. 445
  pathology of, i. 396
  physiology of, i. 323
  signs of, i. 358
  skin diseases, i. 441
Premature induction of labor, ii. 194
  infant, management of, i. 307
  labor, i. 302
Presentation, compound, i. 758
  of breech, i. 606
  of face, i. 592
  of shoulder, i. 755
  of trunk, i. 625
  of vertex, i. 560
Presentations, abnormal, i. 755
Prolapse of umbilical cord, i. 794
Pseudencephalia, i. 766
Psychical changes in pregnancy, i. 350
Puerperal fever, etiology of, ii. 401
  infection, ii. 290
  insanity, ii. 545
  state, cerebral hemorrhage in, ii. 626
    chorea in, ii. 590
    complications of, non-infectious, ii 461
    diastasis of abdominal muscles in, ii. 524
    diseases of urinary system in, ii. 525
    embolus in, ii. 626
    epilepsy in, ii. 622
    erysipelas in, ii. 513
    exanthemata in, ii. 506
    flatulence in, ii. 524
    gonorrhœa in, ii. 521
    hæmatoma in, ii. 485
    hæmaturia in, ii. 534
    hemorrhage in, ii. 475
    insanity in, ii. 545
    malaria in, ii. 317
    neuroses in, ii. 590
    non-infectious fevers in, ii. 491

Puerperal state, physiology and management of, i. 519
  pneumonia in, ii. 502
  pressure-palsies in, ii. 629
  rheumatism in, ii. 519
  skin diseases in, ii. 523
  tetanus in, ii. 608
  tetany in, ii. 621

R.

Rachitis, fœtal, i. 277
Relaxation of pelvic joints, ii. 543
Renal diseases in pregnancy, i. 435
  in puerperal state, ii. 525
Rheumatism in puerperal state, ii. 519

S.

Sepsis in infants, ii. 724
Septic affections of infants, ii. 724
Sex, determination of, i. 216
Shortness of umbilical cord, i. 789
Shoulder presentation, i. 755
Signs of pregnancy, i. 358
Skin, diseases of, in pregnancy, i. 441
  diseases in puerperal state, ii. 523
Souffle, fœtal, i. 380
  uterine, i. 381
Spermatogenesis, i. 97
Spina bifida, ii. 657, 804
Sudden death in labor, ii. 104
Superfœtation, i. 221
Surgical diseases of infants, ii. 763
Syphilis, fœtal, treatment of, i. 268
  in pregnancy, i. 453
Symphysiotomy, ii. 270

T.

Tetanus in infants, ii. 682
  in puerperal state, ii. 621
Tetany in puerperal state, ii. 608
Third stage of labor, mechanism of, i. 628
Thrush in infants, ii. 742
Trunk presentation, i. 625
Tuberculosis in pregnancy, i. 456
Turning, ii. 209.

U.

Umbilical cord, i. 130
    anomalies of, i. 253
    prolapse of, i. 794
    shortness of, i. 789
  hemorrhage in infants, ii. 719
  vegetations in infants, ii. 717
Urinary diseases in puerperal state, ii. 525
Urine in pregnancy, i. 354
Uterine inertia, i. 694
Uterus, anomalous involution of, ii. 461
  displacements of, in pregnancy, i. 457
  inversion of, ii. 40

V.

Vegetations, umbilical, in infants, ii. 717
Version, ii. 209
  combined, i. 49
Vertex presentation, i. 560
Vomiting, pernicious, in pregnancy, i. 409

W.

Womb, displacements of, in pregnancy, i. 457

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